

U.S. EPA New England, Region 1

Interim Record of Decision

for

Federal Facility
New London Naval Submarine Base
Superfund Site

Operable Unit 09

Groton, Connecticut

December 30, 2004

**Interim
Record of Decision
for
Sites 3, 7, 14, 15, 18, and 20
Groundwater**

**Naval Submarine Base
New London
Groton, Connecticut**



**Department of the Navy
Engineering Field Activity Northeast
Naval Facilities Engineering Command
Lester, Pennsylvania**

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LIST OF ACRONYMS

ARAR	Applicable or Relevant and Appropriate Requirement
Atlantic	Atlantic Environmental Services, Inc.
B&RE	Brown & Root Environmental
BGOURI	Basewide Groundwater Operable Unit Remedial Investigation
bgs	Below ground surface
CB	Chlorobenzene
CERCLA	Comprehensive Environmental Response, Compensation, and Liability Act
CFR	Code of Federal Regulations
CGS	Connecticut General Statutes
CLEAN	Comprehensive Long-Term Environmental Action Navy
COC	Chemical of Concern
COPC	Chemical of potential concern
C _{sw}	Contaminant concentration in surface water
CTDEP	Connecticut Department of Environmental Protection
CTE	Central tendency exposure
DCB	Dichlorobenzene
DDD	1,1-Dichloro-2,2-bis(4-chlorophenyl)ethane
DDT	1,1,1-Trichloro-2,2-bis(4-chlorophenyl)ethane
DGI	Data Gap Investigation
DRMO	Defense Reutilization and Marketing Office
EEQ	Ecological effects quotient
Envirodyne	Envirodyne Engineers, Inc.
EPA	United States Environmental Protection Agency
ERA	Ecological risk assessment
ESQD	Explosive Safety Quantity Distance
FFA	Federal Facility Agreement
FFS	Focused Feasibility Study
FS	Feasibility Study
GA/GAA/GB	CTDEP Groundwater Quality Classifications
GAC	Granular activated carbon
HCB	Hexachlorobenzene
HHRA	Human health risk assessment
HI	Hazard index
HQ	Hazard quotient
HSWA	Hazardous and Solid Waste Amendment

IAS	Initial Assessment Study
ICR	Incremental cancer risk
IEUBK	Integrated Exposure Uptake Biokinetic
IR	Installation Restoration
J	Estimated result
MCL	Maximum Contaminant Level
mg/kg	milligrams per kilogram (parts per million)
mg/L	milligrams per liter (parts per million)
NAVD	North American Vertical Datum
Navy	United States Department of the Navy
NCP	National Oil and Hazardous Substances Pollution Contingency Plan
NFA	No further action
ng/kg	nanograms per kilogram (parts per million)
NPDES	National Pollutant Discharge Elimination System
NPL	National Priorities List
NSA	New Source Area
NSB-NLON	Naval Submarine Base - New London
NTCRA	Non-Time-Critical Removal Action
NTU	Nephelometric turbidity unit
O&M	Operation & maintenance
OBDA	Overbank Disposal Area
OBDANE	Overbank Disposal Area Northeast
OSWER	Office of Solid Waste and Emergency Responses
OU	Operable Unit
PAH	Polynuclear aromatic hydrocarbon
PCB	Polychlorinated biphenyl
POTW	Publicly-owned treatment works
PPE	Personnel protective equipment
PRG	Preliminary Remediation Goal
RA	Remedial action
RAB	Restoration Advisory Board
RAGS	Risk Assessment Guidance for Superfund
RAO	Remedial action objective
RCRA	Resource Conservation and Recovery Act
RCSA	Regulations of Connecticut State Agencies
RfD	Reference dose
RG	Remedial goal

RI	Remedial Investigation
RME	Reasonable maximum exposure
ROD	Record of Decision
RSR	Remediation Standard Regulations (Connecticut)
SARA	Superfund Amendments and Reauthorization Act
SVOC	Semivolatile organic compound
SwSV	Surface water screening value
TAG	Technical Assistance Grant
TAL	Target analyte list
TBC	To Be Considered
TCE	Trichloroethene
TCL	Target compound list
TCRA	Time-Critical Removal Action
TDS	Total dissolved solids
TPH	Total petroleum hydrocarbons
TSS	Total suspended solids
TtNUS	Tetra Tech NUS, Inc.
U	Parameter not detected. The value reported is the detection limit.
USGS	United States Geologic Survey
UST	Underground storage tank
UTL	Upper Tolerance Limit
VC	Vinyl chloride
VOC	Volatile organic compound
WQSs	Water Quality Standards
µg/kg	micrograms per kilogram (parts per billion)
µg/L	micrograms per liter (parts per billion)

GLOSSARY OF TECHNICAL TERMS

This glossary defines terms used in this Record of Decision (ROD). The definitions apply specifically to this ROD and may have other meanings when used in different circumstances.

Administrative Record File: A file that contains all information used by the lead agency to make its decision in selecting a response under CERCLA. This file is to be available for public review, and a copy is to be established at or near the site, usually at one of the information repositories. Also, a duplicate is filed in a central location, such as a regional or state office.

Applicable or Relevant and Appropriate Requirements (ARARs): The federal and state environmental rules, regulations, and criteria that must be met by the selected remedy under Superfund.

Carcinogen: A substance that may cause cancer.

Chemical of Concern (COC): A regulated chemical that is present at a concentration deemed to pose an unacceptable risk to human health or the environment, taking into account the acceptable level of risk land-use definitions (i.e., current and reasonable potential future), and exposure scenario (i.e., completed pathways).

Chemical of Potential Concern (COPC): A chemical identified as a potential concern to human health or the environment through a screening-level assessment because its concentration exceeds regulatory criteria.

Comment Period: A time during which the public can review and comment on various documents and actions taken, either by the Navy, EPA, or CTDEP. For example, a comment period is provided when EPA proposes to add sites to the National Priorities List. A minimum 30-day comment period is held to allow community members to review the Administrative Record file and review and comment on the Proposed Plan.

Community Relations: The Navy and NSB-NLON program to inform and involve the public in the Superfund process and to respond to community concerns.

Comprehensive Environmental Response, Compensation, and Liability Act (CERCLA), 42 U.S.C. 9601 et seq.: A federal law passed in 1980 and modified in 1986 by the Superfund Amendments and Reauthorization Act (SARA) Public Law 99-499. The act created a special tax that goes into a trust fund

to investigate and clean up abandoned or uncontrolled hazardous waste sites. Under the program, EPA can do either of the following:

- Pay for site cleanup when parties responsible for the contamination cannot be located or are unwilling to perform the work.
- Take legal action to force parties responsible for site contamination to clean up the site or pay back the federal government for the cost of the cleanup.

Contamination: Any physical, biological, or radiological substance or matter that, at a certain concentration, could have an adverse effect on human health and the environment.

Data Gap Investigation (DGI): A follow-up investigation performed to address data gaps identified in the results of the previous investigation.

Feasibility Study (FS): A report that presents the development, analysis, and comparison of remedial alternatives.

Five-Year Review: Review of any remedial action that results in any hazardous substances, pollutants, or contaminants remaining at the site. The review is conducted no less often than each 5 years after the initiation of the remedial action.

Groundwater: Water found beneath the earth's surface. Groundwater may transport substances that have percolated downward from the ground surface as it flows towards its point of discharge.

Hazard Index (HI): Sum of the HQs for all chemicals and all routes of exposure.

Hazard Quotient (HQ): The ratio of the daily intake of a chemical from on-site exposure divided by the reference dose for that chemical. The reference dose represents the daily intake of a chemical that is not expected to cause adverse health effects.

Incremental Cancer Risk (ICR): The incremental increase in the probability of developing cancer during one's lifetime from exposure to carcinogenic chemicals in addition to the background probability of developing cancer. The EPA Incremental Cancer Risk goal is between 1×10^{-6} (1 in a million) and 1×10^{-4} (1 in ten thousand) chance of cancer. Cancer risk less than or within the risk goal is considered an acceptable risk level by the EPA. The CTDEP Incremental Cancer Risk Guideline is 1×10^{-5} (1 in a

hundred thousand) and applies to cumulative risk posed by multiple contaminants. The State's acceptable carcinogenic risk for individual pollutants is 1×10^{-6} (1 in a million).

Information Repository: A file containing information, technical reports, and reference documents regarding a Superfund site that is made available to the public.

Installation Restoration (IR) Program: The purpose of the program is to identify, investigate, assess, characterize, and clean up or control releases of hazardous substances, and to reduce the risk to human health and the environment from past waste disposal operations and hazardous material spills at Navy activities in a cost-effective manner.

Institutional Controls: Institutional Controls are a subset of Land Use Controls and are primarily legal mechanisms (non-engineering) imposed to ensure the continued effectiveness of land use restrictions imposed as part of a remedial decision. Legal mechanisms include restrictive covenants, negative easements, equitable servitudes, and deed notifications. Administrative mechanisms include notices, adopted local land use plans and ordinances, construction permitting, or other existing land use management systems that may be used to ensure compliance with use restrictions.

JP-10: A popular missile fuel which is a single-component hydrocarbon ($C_{10}H_{16}$), rather than a mixture of many hydrocarbons. JP-10 fuel is a storable liquid.

Land Use Controls: Any type of physical, legal, or administrative mechanism that restricts the use of, or limits access to, real property including water resources to prevent or reduce risks to human health and the environment. Physical mechanisms encompass a variety of engineered remedies to contain or reduce contamination and/or physical barriers to limit access to property, such as fences or signs. The legal mechanisms used for LUCs are generally the same as those used for Institutional Controls.

Monitoring: Periodic or continuous surveillance or testing to determine the level of compliance with statutory requirements and/or pollutant levels in various media or in humans, plants, and animals.

National Oil and Hazardous Substances Pollution Contingency Plan (NCP), 40 CFR Part 300: Federal regulations that provide the organizational structure and procedures for preparing for and responding to discharges of oil and release of hazardous substances, pollutants, or contaminants.

National Priorities List (NPL): The EPA list of the most serious uncontrolled or abandoned hazardous waste sites identified for possible long-term remedial response. The list is based on the score a site receives in the Hazard Ranking System. EPA is required to update the NPL at least once a year.

Natural Degradation: Natural degradation processes include a variety of physical, chemical, or biological processes that, under favorable conditions, act without human intervention to reduce the mass, toxicity, mobility, volume, or concentration of contaminants in soil and ground water. These in-situ processes include biodegradation, dispersion, dilution, sorption, volatilization, and chemical or biological stabilization, transformation, or destruction of contaminants.

Operable Unit (OU): Operable units are site management tools that define discrete steps towards comprehensive actions as part of a Superfund site cleanup. They can be based on geological portions of a site, specific site problems, initial phases of action, or any set of actions performed over time or concurrently at different parts of the site.

Organic Compounds: Naturally occurring or man-made chemicals containing carbon. Volatile organics can evaporate more quickly than semivolatile organics. Some organic compounds may cause cancer; however, their strength as cancer-causing agents can vary widely. Other organics may not cause cancer but may be toxic. The concentrations that can cause harmful effects can also vary widely.

Otto Fuel II: Otto Fuel II is a distinct-smelling, reddish-orange, oily liquid that the Navy uses as a fuel for torpedoes and other weapon systems. It is a mixture of three synthetic substances: propylene glycol dinitrate (the major component), 2-nitrodiphenylamine, and dibutyl sebacate and produces hydrogen cyanide when burned. Propylene glycol dinitrate, a colorless liquid with an unpleasant odor, is explosive. 2-Nitrodiphenylamine is an orange solid used to control the explosion of propylene glycol dinitrate. Dibutyl sebacate is a clear liquid used for making plastics, many of which are used for food packaging. It is also used to enhance flavor in some foods such as ice cream, candy, baked goods, and nonalcoholic drinks, and is found in some shaving creams.

Polynuclear Aromatic Hydrocarbons (PAHs): High molecular weight, relatively immobile, and moderately toxic solid organic chemicals featuring multiple benzenic (aromatic) rings in their chemical formula. Typical examples of PAHs are naphthalene and phenanthrene.

Proposed Plan: A public participation requirement of SARA in which the lead agency summarizes for the public the preferred cleanup strategy and the rationale for preference and reviews the alternatives presented in the detailed analysis of the FS. The Proposed Plan may be prepared either as a fact sheet or as a separate document. In either case, it must actively solicit public review and comment on all alternatives under consideration.

Record of Decision (ROD): An official document that describes the selected Superfund remedy for a site. The ROD documents the remedy selection process and is issued by the Navy and EPA following the public comment period.

Remedial Investigation (RI): A report that describes the site, documents the nature and extent of contaminants detected at the site, and presents the results of the risk assessment.

Remedial Action: The actual construction or implementation phase that follows the remedial design for the selected cleanup alternative at a site on the NPL.

Response Action: As defined by CERCLA Section 101(25), means remove, removal, remedy, or remedial action, including enforcement activities.

Responsiveness Summary: A summary of written and oral comments received during the public comment period, together with the Navy's and EPA's responses to these comments.

Risk Assessment: Evaluation and estimation of the current and future potential for adverse human health or environmental effects from exposure to contaminants.

Source: Area(s) of a site where contamination originates.

Superfund: The trust fund established by CERCLA that can be drawn upon to plan and conduct cleanups of past hazardous waste disposal sites and current releases or threats of releases of non-petroleum products. Superfund is often divided into removal, remedial, and enforcement components.

Superfund Amendments and Reauthorization Act (SARA): The public law enacted on October 17, 1986 to reauthorize the funding provisions and amend the authorities and requirements of CERCLA and associated laws. Section 120 of SARA requires that all federal facilities be subject to and comply with this act in the same manner and to the same extent as any non-government entity.

TH Dimer: Tetrahydromethylcyclopentadiene, also called RJ-4, is a fuel developed for ram-jet missiles. It has been used for the Navy Sea Launched Cruise Missile. It can be used alone or blended with other fuels (e.g., a component of JP-9 jet fuel).

1.0 DECLARATION

1.1 SITE NAME AND LOCATION

This Interim Record of Decision (ROD) includes the groundwater at the following sites:

- Site 3 - Area A Downstream Watercourses and Overbank Disposal Area (OBDA)
- Site 7 - Torpedo Shops
- Site 14 - Overbank Disposal Area Northeast (OBDANE)
- Site 15 - Spent Acid Storage and Disposal Area
- Site 18 - Solvent Storage Area, Building 33
- Site 20 - Area A Weapons Center

These sites are a portion of Basewide Groundwater Operable Unit (OU) 9.

Naval Submarine Base – New London (NSB-NLON)

Groton, Connecticut

CERCLIS ID No. CTD980906515

1.2 STATEMENT OF BASIS AND PURPOSE

This Interim ROD presents the Selected Remedies for the groundwater at Sites 3, 7, 14, 15, 18, and 20 at NSB-NLON, Groton, Connecticut. Sites 3, 7, 14, and 20 are located in the northern portion of NSB-NLON in close proximity to each other and the groundwater is hydraulically connected. Sites 15 and 18 are located in the southern portion of NSB-NLON, but Sites 15 and 18 groundwater are also portions of OU9. The Selected Remedies were chosen in accordance with the Comprehensive Environmental Response, Compensation, and Liability Act (CERCLA), 42 U.S.C. 9601 et seq., as amended by the Superfund Amendments and Reauthorization Act (SARA), Public Law 99-499, and, to the extent practicable, the National Oil and Hazardous Substances Pollution Contingency Plan (NCP), 40 CFR Part 300. These decisions are based on information contained in the Administrative Record for these sites.

The United States Department of the Navy (Navy) and the United States Environmental Protection Agency (EPA) Region I issue this Interim ROD (jointly). The State of Connecticut Department of Environmental Protection (CTDEP) concurs with the Selected Remedies.

1.3 ASSESSMENT OF SITE

The remedial action (RA) selected in this Interim ROD for Sites 3 and 7 groundwater is necessary to protect public health or welfare or the environment from actual or threatened releases of pollutants or contaminants from this site.

The Navy has determined that No Further Action (NFA) is necessary for the groundwater at Sites 14, 15, 18, and 20 to protect public health or welfare or the environment.

1.4 DESCRIPTIONS OF SELECTED REMEDIES

A total of 12 OUs have been defined at NSB-NLON to address the 25 sites included in the NSB-NLON Installation Restoration (IR) Program. This Interim ROD only applies to the groundwater at Sites 3, 7, 14, 15, 18, and 20. The groundwater at these sites is only a portion of the Basewide Groundwater OU9. Final actions for OU9 will be selected after interim actions have been selected for all portions of OU9.

The interim remedy for Sites 3 and 7 groundwater requires the development and implementation of response measures that will protect human health and the environment from contaminated groundwater at these sites. NFA is necessary for Sites 14, 15, 18, and 20 groundwater. The soil at Site 3 (OU3), Site 3 – New Source Area (NSA), Site 7 (OU8), Site 14 (OU8), Site 15 (OU6), Site 18 (a portion of OU 11), and the soil and sediment at Site 20 (OU7) were addressed in separate RODs or other decision documents.

1.4.1 Sites 3 and 7

The multiple phases of investigations at Sites 3 and 7 included sampling and analyzing soil, sediment, surface water, and groundwater. The human health risk assessment (HHRA) and ecological risk assessment (ERA) indicated there are no unacceptable risks to current human or ecological receptors from exposure to groundwater, but there are potentially significant risks to hypothetical future human receptors from routine, long-term consumption of contaminated groundwater. The Selected Remedy for Sites 3 and 7 groundwater is Institutional Controls with Monitoring. The Selected Remedy for the groundwater at these two sites is an interim remedy, but it is expected that it will be the final remedy once remedial actions are selected for all portions of OU9. The Selected Remedy complies with regulatory requirements and includes the following major components:

- Implementation of institutional controls that identify the location and magnitude of groundwater contamination and restrict extraction and use of the groundwater. The details of the administration of the institutional controls will be provided in the Remedial Design documentation. In the event of

property transfer and with confirmation that contaminated groundwater remains at the sites, a deed restriction would be used to prohibit the use of groundwater.

- Monitoring the degradation and potential migration of groundwater contaminants until concentrations decrease to the remedial goals by natural processes and the resulting concentrations are shown to be protective of human health and the environment. Additional details regarding the scope and duration of the monitoring program will be provided in the groundwater monitoring plan which will be part of the Remedial Design documentation.

1.4.2 Sites 14 and 20

The multiple phases of investigations included sampling and analyzing soil and groundwater at Site 14 and soil, sediment, surface water, and groundwater at Site 20. The HHRAs for Sites 14 and 20 indicated there are no unacceptable risks to human health or the environment from current or potential future exposure to groundwater at the sites. The selected NFA remedy for the groundwater at these two sites is an interim remedy, but it is expected that it will be the final remedy once remedial actions are selected for all portions of OU9.

- The Selected Remedy for Sites 14 and 20 groundwater is NFA.

1.4.3 Sites 15 and 18

Samples of Sites 15 and 18 soil and groundwater were collected and analyzed. The analytical data were evaluated and HHRAs were conducted. The risk assessments concluded that there were no unacceptable risks to human health from exposure to groundwater at these sites. Ecological risk assessments were not performed for these sites because none of them provide suitable ecological habitat, i.e., Site 15 is a paved area and Site 18 is a building. Based on this information, NFA was selected for Sites 15 and 18 groundwater. These sites pose no current or future potential threat to human health or the environment; therefore, the Navy will not implement any treatment, engineering controls, or institutional controls. The selected NFA remedy for the groundwater at these two sites is an interim remedy, but it is expected that it will be the final remedy once remedial actions are selected for all portions of OU9.

- The Selected Remedy for Sites 15 and 18 groundwater is NFA.

1.5 STATUTORY DETERMINATIONS

The interim remedies for Sites 3, 7, 14, 15, 18, and 20 groundwater are protective of human health and the environment in the short term and provide adequate protection until a final ROD is signed for OU9; comply with federal and state requirements that are applicable or relevant and appropriate to the remedial actions; and are cost effective.

The Selected Remedy for Sites 3 and 7 groundwater does not satisfy the statutory preference for treatment as a principal element of the remedy. Due to the sporadic and relatively low concentrations of contaminants in groundwater, the Navy has determined that incorporating technologies to actively reduce the toxicity of the contaminants on site would not be cost effective. Treatment is not necessary for Sites 14, 15, 18, and 20 groundwater because the Selected Remedy is NFA.

Because the Selected Remedy for Sites 3 and 7 groundwater will not result in the removal of contaminants at concentrations greater than the remedial goals from the site, the Selected Remedy will not allow for the clean closure of Sites 3 and 7 groundwater. Therefore, five-year reviews will be required. The selected alternative is cost effective when compared to the other evaluated alternatives because it depends on passive remedial actions such as implementation of land use controls, degradation of contaminants through natural processes, and completion of groundwater monitoring.

The selection of the NFA remedies for Sites 14, 15, 18, and 20 groundwater are based on the investigation and risk assessment results that indicated that no remedial actions are necessary to ensure protection of human health and the environment. Because the remedies will not result in hazardous substances, pollutants or contaminants remaining on site above levels that allow for unlimited use and unrestricted exposure, 5-year reviews of these sites will not be required.

1.6 ROD DATA CERTIFICATION CHECKLIST

The following information is included in the Decision Summary section of this ROD:

- Chemicals of concern (COCs) and their respective concentrations.
- Baseline risk represented by the COCs.
- Cleanup levels (i.e., remedial goals) established for COCs and the basis for these levels.
- How source materials constituting principal threats are addressed.

- Current and reasonably anticipated future land use assumptions and current and potential future beneficial uses of groundwater used in the baseline risk assessments and ROD.
- Potential land and groundwater use that will be available at the sites as a result of the Selected Remedies.
- Estimated capital, annual operation and maintenance (O&M), and total present worth costs, discount rates, and the number of years over which the remedy cost estimates are projected.
- Key factor(s) that led to selecting the remedies (i.e., description of how the Selected Remedies provide the best balance of tradeoffs with respect to the balancing and modifying criteria, highlighting criteria key to the decision).

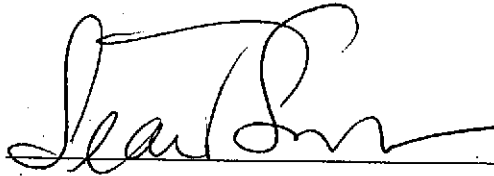
Additional information can be found in the Administrative Record for Sites 3, 7, 14, 15, 18, and 20 groundwater.

1.7 AUTHORIZING SIGNATURES

The signatures provided on the following pages validate the selection of the interim remedies for the groundwater at Sites 3, 7, 14, 15, 18, and 20, a portion of OU9, by the Navy and EPA, respectively. The CTDEP concurs with the Selected Remedies.

DECEMBER 2004

Concur and recommend for implementation:

 CAPT, USN

Capt. Sean P. Sullivan, USN
Commanding Officer
Naval Submarine Base - New London

12/23/04
Date

DECEMBER 2004

Concur and recommend for implementation:

Susan Studlien

Susan Studlien, Director
Office of Site Remediation and Restoration
EPA Region I

12/30/04

Date

2.0 DECISION SUMMARY

This Interim ROD describes the remedies selected by the Navy and EPA for Sites 3, 7, 14, 15, 18, and 20 groundwater to protect human health and the environment until a final ROD is signed for OU9. The Navy is the lead agency for CERCLA activities at NSB-NLON and provides the funding for the cleanup activities. The EPA provides the primary regulatory oversight and enforcement for the CERCLA activities at NSB-NLON, but the CTDEP is also actively involved in supporting the activities as required under the Federal Facility Agreement (FFA) (EPA, 1995).

2.1 SITE NAME, LOCATION, AND BRIEF DESCRIPTION

NSB-NLON is located in southern Connecticut in the towns of Ledyard and Groton. NSB-NLON is situated on the eastern bank of the Thames River, approximately 6 miles north of Long Island Sound. It is bordered on the east by Connecticut Route 12, on the south by Crystal Lake Road, and on the west by the Thames River. The northern border is a low ridge that trends approximately east-southward from the Thames River to Baldwin Hill. A general facility location map is presented as Figure 2-1. The location of each IR Program site within NSB-NLON is shown on Figure 2-2.

2.1.1 Site 3

Site 3 is located in the northern portion of NSB-NLON and includes undeveloped wooded areas featuring several small ponds, streams, and wetlands and recreation areas (golf course and lake for swimming). Site 3 covers approximately 75 acres. Site 3 receives surface water and groundwater recharge from the Area A Landfill (Site 2A), Area A Wetland (Site 2B), Site 7, Site 14, and surrounding areas and convey them to the Thames River. Site 3 includes North Lake and several small ponds (Upper Pond, Lower Pond, and OBDA Pond) and interconnected streams (Streams 1 through 6). The major sources of contamination to Site 3 included historic application of pesticides, abandoned disposal areas, and the septic system leach fields at Site 7. The general configuration of Site 3 and adjacent areas is shown on Figure 2-3.

The primary discharge points from Site 2B to Site 3 are through four 24-inch diameter metal culvert pipes located within the dike that separates the Site 2B from Site 3. The discharge from these culverts forms a small stream (Stream 4) that flows westward for approximately 200 feet into Upper Pond. Upper Pond discharges to Stream 3, which flows northward and then westward toward Triton Road (past the OBDANE site) to the entrance of Site 7. At this location, it meets the drainage channel from Site 7 and forms Stream 5. Stream 5 flows westward along Triton Road through the Small Arms Range, under Shark Boulevard, and eventually discharges to the Thames River at the Defense Reutilization and Marketing

Office (DRMO) outfall. Upper Pond also has a discharge structure on the southern side. A second pond (Lower Pond), northwest of Upper Pond, is a natural depression and is recharged by groundwater inflow. The outlet of the pond forms Stream 2, which enters a storm sewer and flows to the west around North Lake.

Groundwater discharges from the Site 2A to a small pond (the OBDA Pond) located at the base of the dike and the OBDA. Stream 1 flows from this pond westward toward North Lake, a recreational swimming area for Navy personnel. Under normal flow conditions, the stream enters a culvert that bypasses North Lake and discharges to a stream (Stream 6) below the outfall of the lake. Stream 6, which is formed by Stream 1, Stream 2, and the outflow of North Lake, flows westward under Shark Boulevard and through the golf course to the Thames River. North Lake is filled with potable water every year and drained at the end of the season. Surface water levels in North Lake do not appear to coincide with groundwater levels in adjacent monitoring wells, indicating little hydraulic connection between surface water of North Lake and the shallow groundwater.

A 9-hole golf course covers a majority of the western portion of Site 3. It was reported that groundwater wells were used to provide irrigation water for the golf course until the early 1980s. These wells were eliminated, and municipal potable water is currently used for irrigation purposes.

Most of Site 3 is within designated Explosive Safety Quantity Distance (ESQD) arcs of Site 20; therefore, further development is not planned for this area. Navy regulations prohibit construction of inhabited buildings or structures within these arcs and, although existing buildings operate under a waiver of these regulations, no further construction is planned.

2.1.2 Site 7

Site 7 is located in the northern portion of NSB-NLON on the northern side of Triton Road. Figure 2-4 shows the general site arrangement. The site is bordered on the east and north by 60-foot-high bedrock cliffs. The remainder of the site slopes to the southwest towards Site 3. An earthen berm extends along the base of the eastern portion of the exposed rock face. Four buildings (325, 450, 477, and 528) exist at the site.

Building 325 is a torpedo overhaul facility. A variety of fuels, solvents, and petroleum products have been used in Building 325 including Otto Fuel II [which is comprised of propylene glycol dinitrate (76 percent), 2-nitrodiphenylamine (1.5 percent), and di-n-butyl sebacate (22.5 percent) and produces hydrogen cyanide when burned], high-octane alcohol (190-proof grain alcohol), and TH-Dimer (jet rocket fuel). Solvents including mineral spirits, alcohol, and 1,1,1-trichloroethane, as well as petroleum products such as motor oil and grease, were also used in this building. A sink in one area was previously used for film

development, and another sink was used for the overhaul of alkaline batteries. This plumbing drained into the on-site septic system until 1983. A maintenance area has a shallow sump covered with flush-mounted steel grating. The area surrounding this sump was previously a washdown/blowdown area for weapons. It is not known where this sump drains, although there is a fair probability that it drains into the south leach field. Two underground and one above ground storage tanks were located on the south side of Building 325 and used to store fuel oil.

A smaller building attached to the eastern side of Building 325 was previously used as an assembly shop for torpedoes and as a paint shop. A closet in this building was used to store containers of 1,1,1-trichloroethane and methyl ethyl ketone (2-butanone). Drums and cylinders were stored outside on the eastern side of this building. The vessels were labeled as containing propane, isobutane, 2-butanone, xylol, methylene chloride, propellant, and zinc chromate. An addition to the northern side of Building 325, completed in 1990, is also used as a torpedo maintenance shop.

Building 450 is the primary MK-48 torpedo overhaul/assembly facility. Petroleum products including TL-250 motor oil and hydraulic fluid have also been used in this building for torpedo maintenance. Torpedo overhaul/assembly operations at Building 450 generate fuels, solvents, and petroleum products as wastes. An Otto fuel and seawater mixture is drained from the torpedoes and replenished with fresh fuel. The Initial Assessment Study (IAS) Report [Envirodyne Engineers, Inc. (Envirodyne), 1983] indicated that Building 450 generates approximately 3,000 gallons of Otto fuel wastewater per month. This building was constructed with a waste collection system that collected waste products from floor drains and discharged them to an underground waste tank/sump with a capacity of approximately 1,500 gallons. The waste tank was pumped periodically and the contents were disposed off site. Otto fuel product was previously stored in a 4,000-gallon underground tank south of Building 450. The hazardous waste sump was decommissioned in 1987. It was replaced with three 1,000-gallon above-ground tanks located south of the building. The floor drains were sealed and replaced with a new system for pumping waste products to the new tanks. A 4,000-gallon above-ground Otto fuel storage tank replaced the previous tank and is located south of the building.

Building 477, approximately 65 feet east of Building 450, was formerly used to store drums of Otto fuel. Solvents including 1,1,1-trichloroethane, trichloroethene (TCE), toluene, mineral spirits, alcohol, and bulk Freon have been used at this facility.

2.1.3 Site 14

Site 14 is centrally located between Sites 7 and 20 in a wooded area on the edge of a ravine just north of Stream 3 in Site 3 (see Figure 2-3). Miscellaneous wastes were dumped at the site in the past. Historical reports state that the vegetation at the site indicated that no dumping had occurred within 10 years prior

to 1982. Inspection of the site verified the presence of several empty fiber drums. No visual soil staining or stressed vegetation were observed. The site was circular and approximately 80 feet in diameter. A dirt road provides limited access to the site. A nearly vertical 20-foot high bedrock face is located at the eastern edge of the site. The rest of the site slopes to the southwest.

2.1.4 Site 15

Site 15 was located in the southern portion of NSB-NLON and was used before and after World War II for the temporary storage of waste battery acid in a rubber-lined underground tank. The tank was centrally located between the southern sides of Buildings 409 and 410. The former site location as well as historic and recent sampling locations are shown on Figure 2-5. The site's location relative to other IR Program sites is depicted on Figure 2-2.

2.1.5 Site 18

Site 18 consists of Building 33, the Solvent Storage Area. The building was used for the storage of gas cylinders and 55-gallon drums of solvents. The location of Building 33 is shown on Figure 2-2 and Figure 2-6.

2.1.6 Site 20

Site 20 consists of Building 524 and the weapons storage bunkers. The storage bunker area is divided into two portions (north and south areas) that were constructed at different times and are of different design. The site is located at the eastern end of Triton Road, adjacent to the northern side of the Site 2B. The general configuration of Site 20 is shown in Figure 2-7.

Site 20 is located near the top of a local topographic and bedrock high. Building 524 was constructed in 1990 and 1991. Portions of the site were blasted to remove bedrock to accommodate construction of the building. The weapons storage bunkers are located southeast and downhill of Building 524 and are adjacent to and at a slightly higher elevation than the Area A Wetland.

Building 524 is used for administration, minor torpedo assembly, and storage of simulator torpedoes. No weapons production takes place in this building. Small quantities of chemicals and chemical waste generated by activities in this building are stored in 1- to 5-gallon containers in seven metal storage cabinets located on a paved area south of the building. The chemicals include cleaning and lubricating compounds, paints, and adhesives. Many of these materials are classified as corrosive or flammable.

Liquid fuels present in the weapons storage bunkers include Otto fuel, JP-10, and TH Dimer (jet rocket fuel). The group of southern area bunkers was reconstructed in the last 15 years. A major part of the reconstruction involved removal of structurally unsuitable soil from the site.

2.2 SITE HISTORY AND ENFORCEMENT ACTIVITIES

2.2.1 Site History

2.2.1.1 Site 3

Site 3 covers approximately 75 acres and contains mainly undeveloped wooded areas and recreational areas [golf course and lake for swimming (North Lake)]. The Site 3 watercourses include several small ponds and interconnected streams (Figure 2-3) that convey surface water to the Thames River. The major sources of contamination at Site 3 included historic application of pesticides for mosquito control, abandoned disposal areas, and the septic system leach fields at Site 7.

An earthen dike was constructed in 1957 in the area between Sites 2 and 3. The valley on the eastern side of the dike was filled with dredge spoils from the Thames River which created the Site 2B. The Site 3 ponds were created to act as settling ponds for any dredge spoil that was discharged from the Site 2B.

Site 3 also included the OBDA. The OBDA was located on the slope of the dike below and adjacent to the Area A Landfill. It was located on the southwestern end of the dike, and a small wetland exists at the base of the dike. The OBDA was used as a disposal site after the earthen dike was constructed in 1957. Materials disposed at the site included thirty 200-gallon metal fuel tanks (unlabeled), scrap lumber/old creosote telephone poles, several empty unlabeled 55-gallon drums, and rolls of wire.

Site 3 was investigated during several phases from 1990 to 2002, including the Phase I Remedial Investigation (RI) [Atlantic Environmental Services, Inc. (Atlantic), 1992], Focused Feasibility Study (FFS) (Atlantic, 1994b), Phase II RI [Brown & Root Environmental (B&RE), 1997], Basewide Groundwater Operable Unit Remedial Investigation (BGOURI) [Tetra Tech NUS, Inc. (TtNUS), 2002a], and Data Gap Investigation (DGI) for the BGOURI Update/Feasibility Study (FS) (TtNUS, 2004). During completion of the Phase II RI, the Navy and regulators decided that the best strategy for the site was to address the source area OUs at the site first and then address the groundwater OU. Groundwater at Site 3 was further investigated during the BGOURI in 2000, but the results of the investigation were inconclusive and data gaps remained.

During the RA for OU3, Site 3 - NSA was discovered adjacent to Stream 5 at Site 3. Sediment that exhibited potential petroleum contamination (i.e., odor and sheen on pooled water) was encountered

during excavation activities along the northern side of Stream 5. Upon further investigation, rusted drums and steel cable intermingled with boulders and soil were evident in a small disposal area upgradient (north) of Stream 5 (see Figure 2-3). A sample of the contaminated sediment was collected and analyzed. Elevated levels of total petroleum hydrocarbons (TPH) were detected in the sample [1,750 milligrams per kilogram (mg/kg) by Method 418.1], indicating the presence of petroleum contamination. The NSA was not remediated at the time of the OU3 RA; however, absorbent booms and hay bales were put in place during construction activities to minimize migration of the contamination downstream, and plastic sheeting was placed along the stream bank prior to backfilling to minimize further contaminant migration to Stream 5.

To address the newly found Site 3 - NSA and the data gaps identified during the BGOURI, a DGI (TtNUS, 2002b) was completed in the fall of 2002 prior to initiating an FS. The results of the DGI were presented and evaluated in the BGOURI Update/FS (TtNUS, 2004) and remedial alternatives were developed to address the petroleum-contaminated soil associated with Site 3 - NSA. A ROD (Navy, 2004d) was signed for the site in October 2004. The ROD called for no further action for the petroleum-contaminated soil under CERCLA because petroleum is excluded from consideration under CERCLA; however, the Navy's cleanup plan to address the petroleum-contaminated soil under other applicable regulations was also detailed in an appendix of the ROD. The Navy anticipates completion of the cleanup of the debris and contaminated soil at Site 3 - NSA in 2005.

2.2.1.2 Site 7

Site 7 is located in the northern portion of NSB-NLON on the northern side of Triton Road (Figure 2-2). The Navy conducts maintenance activities on torpedoes at the site. OU8 is the soil OU associated with Site 7. The major sources of contamination at Site 7 included potential historic disposal of solvents/chemicals into two on-site septic systems and leaks or spills associated with on-site underground storage tanks (USTs). Contaminated soil was found on the southern side of Building 325 and appears to be related to former USTs used to store fuel oil. Groundwater and suspected soil contamination on the western side of the building appears to be related to the septic tank, sewer lines, or leach field associated with the former septic system. The USTs were closed in the 1990s, and the septic systems were abandoned when sanitary sewers were installed in 1983.

Building 325 (Figure 2-4) is a torpedo overhaul facility, and it was built in 1955 and had an on-site septic system until 1983, when all of the building's plumbing facilities were connected to sanitary sewers. The original septic leach field for Building 325 is located southwest of the building, adjacent to Triton Road. This leach field became clogged in 1975 and was abandoned. A new leach field (south leach field) was constructed next to the original leach field and was used until sanitary sewers were installed in 1983.

Two underground No. 2 fuel oil tanks were located on the southern side of Building 325. One of the tanks was closed in 1995. A third tank, which was located above ground adjacent to the building, was used for temporary storage of No. 2 fuel oil but, based on field reconnaissance, had been removed as of March 15, 1995.

Building 450 (Figure 2-4) is the primary MK-48 torpedo overhaul/assembly facility. It was built in 1974 and was served by its own septic system until 1983, when it was connected to sanitary sewers. Only domestic wastewater from toilets, lavatories, and showers in Building 450 had been directed to the septic field (north leach field).

Site 7 was investigated during the Phase I RI (Atlantic, 1992), Phase II RI (B&RE, 1997), and BGOURI (TtNUS, 2002a). The combined soil and groundwater data sets from the three investigations were evaluated during the BGOURI. No additional investigations were conducted at the site during the DGI for the BGOURI Update/FS.

A ROD (Navy, 2004b) was signed for the soil at the site (OU8) in September 2004 which called for the excavation and off-site disposal of contaminated soil. This remedy was selected because there were potentially significant risks associated with exposure to the contaminated soil. The Navy is currently conducting the Remedial Design for the contaminated soil and anticipates that the Remedial Action will be completed in 2005.

2.2.1.3 Site 14

Site 14, where miscellaneous wastes were dumped in the past, was located adjacent to Sites 3 and 7 in a wooded area on the edge of a ravine just north of Stream 3 (Figure 2-3). Site 14 was investigated during the Phase I RI (Atlantic, 1992), Phase II RI (B&RE, 1997), and BGOURI (TtNUS, 2002a). A Non-Time-Critical Removal Action (NTCRA) was completed at the site in 2001 to address the contaminated soil and debris identified at the site during the Phase II RI. A ROD (Navy, 2004b) was signed for the soil at the site (OU8) in September 2004 which called for no further action. This remedy was selected because the NTCRA addressed all significant risks associated with the soil and debris.

Because Site 14 was located adjacent to Site 3 and groundwater from Site 14 flows toward Site 3, it was decided to evaluate the groundwater OU beneath both sites jointly and this approach was taken in the BGOURI. Subsequently, it was decided that groundwater at Sites 3 and 14 should be evaluated separately because of the different remedial strategies that might be applicable to the different sites. This approach was used in the BGOURI Update/FS (TtNUS, 2004). No additional sampling was conducted at Site 14 during the DGI for the BGOURI Update/FS because no significant contamination was discovered in the groundwater during the BGOURI.

2.2.1.4 Site 15

Site 15 was used before and after World War II for the temporary storage of waste battery acid in a rubber-lined underground tank. The tank was reportedly 12 feet long by 4 feet wide by 4 feet high. The batteries were placed on a concrete pad next to the tank onto which some acids occasionally leaked. No major spills were ever recorded. A 1951 aerial photograph shows that the area around the tank was not paved. Acid from the batteries was stored in the tank and was subsequently pumped into a tank truck and disposed in the Area A Landfill (Site 2). The tank was filled in place with soil and capped with bituminous pavement.

Historical investigations completed at Site 15 include the Phase I RI (Atlantic, 1992), FFS (Atlantic, 1994a), Phase II RI (B&RE), 1997, Supplemental Sampling Event (CTDEP, 1997), and BGOURI (TtNUS, 2002a). Groundwater and soil data collected at Site 15 during the DGI was included and evaluated in the BGOURI Update/ FS Report (TtNUS, 2004).

2.2.1.5 Site 18

The solvent storage area at Building 33 was identified during the IAS (Envirodyne, 1983) for NSB-NLON. The site was identified as Study Area F in the FFA and is now identified as Site 18 for the IR Program. Site 18 was used for the storage of gas cylinders and 55-gallon drums of solvents such as TCE and dichloroethene. The site was not identified as a high priority site and as a result, no investigation of Site 18 was conducted during the early phases of investigation at NSB-NLON (e.g., Phase I or Phase II RIs). The Navy investigated the site during the BGOURI in 2000 to determine the impact of the operation of the storage facility. Both soil and groundwater samples were collected to characterize the site. The results of the investigation were documented in the BGOURI Report (TtNUS, 2002a). A ROD (Navy, 2004c) was subsequently signed for the soil at Site 18 (OU11) in September 2004. The ROD called for no further action because no significant risks associated with exposure to site soil were identified during the RI.

2.2.1.6 Site 20

Site 20 consists of Building 524, which is used for administration, minor torpedo assembly, and storage of simulator torpedoes, and the weapons storage bunkers (see Figure 2-7). Small quantities of chemicals (cleaning and lubricating compounds, paints, and adhesives) and chemical waste generated by on-site activities are stored at the site. Liquid fuels present in the weapons storage bunkers include Otto fuel, JP-10, and TH Dimer (jet rocket fuel).

Site 20 was indirectly investigated during the Phase I RI (Atlantic, 1992) as part of the investigation of Site 2B. The site was further investigated during the Phase II RI (B&RE, 1997), BGOURI (TtNUS, 2002a), and DGI for the BGOURI Update/FS (TtNUS, 2004). The DGI (TtNUS, 2002b), which included collection and analysis of additional groundwater samples, was conducted at the site in the fall of 2002 to address data gaps identified during the BGOURI. A ROD (Navy, 2000) for the site soil and sediment (OU7) was signed and called for excavation and off-site disposal of the contaminated soil and sediment.

2.2.2 Enforcement Activities

On August 30, 1990, NSB-NLON was placed on the National Priorities List (NPL) by the EPA pursuant to CERCLA of 1980 and SARA of 1986. The NPL is a list of uncontrolled or abandoned hazardous waste sites identified by EPA as requiring priority RAs.

The Navy, EPA, and the State of Connecticut signed the FFA (EPA, 1995) for NSB-NLON. The agreement is used to ensure that environmental impacts associated with past and present activities at NSB-NLON are thoroughly investigated and that the appropriate RA is pursued to protect human health and the environment. In addition, the FFA establishes a procedural framework and timetable for developing, implementing, and monitoring appropriate responses at NSB-NLON, in accordance with CERCLA (and SARA amendment of 1986, Public Law 99-499), 42 U.S.C. §9620(e)(1); the National Oil and Hazardous Substance Pollution Contingency Plan (NCP), 40 CFR 300; Resource Conservation and Recovery Act (RCRA), 42 U.S.C. §6901 et seq., as amended by the Hazardous and Solid Waste Amendment (HSWA) of 1984, Executive Order 12580; and applicable State laws.

Sites 3, 7, 14, 15, 18, and 20 are six of 25 sites being addressed by the Navy's IR Program at NSB-NLON. The combined groundwater data set from previous investigations was provided and evaluated in the BGOURI (TtNUS, 2002a). Groundwater data from the DGI were included and evaluated in the BGOURI Update/FS (TtNUS, 2004) to develop appropriate remedial alternatives.

2.2.2.1 Site 3

A Time-Critical Removal Action (TCRA) for the OBDA was completed in 1997 (Navy, 1997a) concurrent with the RA for Site 2A. Accumulated debris at the OBDA, including discarded wooden pallets, telephone poles, and empty tanks, was removed and disposed off site.

OU3, Site 3 soil and sediment, was remediated during 1999 and 2000 to meet the objectives of the ROD (Navy, 1998). Approximately 18,050 tons of pesticide- and metals-contaminated soil and sediment were excavated and disposed at off-site disposal facilities. Activities are ongoing to restore the site to its natural condition.

The Navy is currently completing plans to address the petroleum-contaminated soil and debris at Site 3 - NSA (OU3) that meet the objectives of the cleanup plan detailed in an appendix of the ROD (Navy, 2004d). The potential volume of petroleum-contaminated soil that will be addressed during the cleanup is 385 cubic yards. The cleanup is currently anticipated to occur in 2005.

2.2.2.2 Site 7

Two USTs at Site 7 were investigated under the State of Connecticut UST regulations to support closure of one tank and to establish that the other tank was operating properly and could remain in service. TPH-contaminated soil was detected at one of the USTs. The contaminated soil was subsequently excavated and disposed at an off-site facility (B&RE, 1996). The soil cleanup goal for the removal action was 500 mg/kg (residential).

A ROD (Navy, 2004b) was signed for the soil at the site (OU8) in September 2004 which called for the excavation and off-site disposal of contaminated soil in two areas at Site 7. The first area includes approximately 90 cubic yards of benzene, chlorobenzene, and dichlorobenzene contaminated soil and a septic tank and the second area includes approximately 1,600 cubic yards of PAH-contaminated soil. This remedy was selected because there were potentially significant risks associated with exposure to the soil. The Navy is currently conducting the Remedial Design for the contaminated soil and anticipates that the Remedial Action will be completed in 2005.

2.2.2.3 Site 14

A Non-Time-Critical Removal Action (NTCRA) was completed at the site in 2001 to address the soil and debris (Navy, 1999a). Approximately 270 tons of material were removed and disposed off site, and the site was subsequently restored. A ROD (Navy, 2004b) was signed for the soil at the site (OU8) in September 2004 which called for no further action. This remedy was selected because the NTCRA addressed all significant risks associated with the soil and debris.

2.2.2.4 Site 15

Based on the results of the Phase I RI and FFS, it was determined that a TCRA was necessary for Site 15. The removal action was completed in 1995 and included removal of the tank, its contents, and 318 tons of lead-contaminated soil. Subsequent to the TCRA, completion of the Phase II RI, and confirmation sampling by the CTDEP, a NFA Source Control ROD was signed for the soil at Site 15 (OU 6) in 1997.

Additional groundwater samples were collected at the site during the BGOURI in 2000, and an evaluation of the analytical results indicated that residual contamination may have remained at the site that was impacting the groundwater. A DGI, which included collection and analysis of additional soil and groundwater samples, was conducted at the site in the fall of 2002 to delineate the extent of remaining source material and confirm the previous groundwater results. The sampling program was focused on the groundwater contaminants (e.g., TCE, chromium, and silver) identified during the BGOURI. The DGI results showed that BGOURI results were anomalies and that there is no contamination remaining in the soil that is acting as a source of contamination to the groundwater and there is no significant groundwater contamination. Based on the results of the DGI, it was determined that there was no need to amend the existing NFA ROD for OU6.

2.2.2.5 Site 18

As a result of the investigation of Site 18, no concerns were identified that would require enforcement activities. A NFA ROD (Navy, 2004c) was signed for the soil at Site 18 (OU11) in September 2004 because no significant risks associated with exposure to site soil were identified during the RI.

2.2.2.6 Site 20

An FS was prepared for the soil and sediment OU (OU7) at Site 20 (EA Engineering, 2000), and a ROD was subsequently signed for OU7 in June 2000 (Navy, 2000). A small (less than 200 cubic yard) soil removal action was conducted at the site in 2001 to address polynuclear aromatic hydrocarbons (PAHs) [benzo(a)anthracene, benzo(a)pyrene, benzo(b)fluoranthene, chrysene, and dibenzo(a,h)anthracene] and arsenic contamination in OU7, Site 20 soil and sediment. The objective of the action, per the ROD, was to mitigate direct contact exposures to soil and sediment by removing contaminated soil in excess of direct-contact residential cleanup goals.

2.3 COMMUNITY PARTICIPATION

The Navy has been conducting community relations activities for the IR Program at NSB-NLON since it began. From 1988 to November 1994, Technical Review Committee meetings were held on a regular basis. In 1994 a Restoration Advisory Board (RAB) was established to increase public participation in the IR Program process.

Many community relations activities for NSB-NLON involve the RAB. The RAB generally meets quarterly. The RAB provides a forum for discussion and exchange of information on environmental restoration activities between the Navy, regulatory agencies, and the community, and it provides an

opportunity for individual community members to review the progress and participate in the decision-making process for various IR Program sites, including Sites 3, 7, 14, 15, 18, and 20.

The following community relations activities are conducted as part of the Community Relations Plan:

Information Repositories: The Public Libraries in Groton and Ledyard are the designated information repositories for the NSB-NLON IR Program. All pertinent reports, fact sheets, and other documents are available at these repositories.

Key Contact Persons: The Navy has designated information contacts related to the NSB-NLON. Materials distributed to the public, including any fact sheets and press releases, will indicate these contacts. The Public Affairs Officer will maintain the site mailing list to ensure that all interested individuals receive pertinent information on the cleanup.

Mailing List: To ensure that information materials reach the individuals who are interested in or affected by the cleanup activities at the NSB-NLON, the Navy maintains and regularly updates the site mailing list.

Regular Contact with Local Officials: The Navy arranges regular meetings to discuss the status of the IR Program with the RAB.

Press Releases and Public Notices: The Navy issues press releases as needed to local media sources to announce public meetings and comment periods, the availability of reports, and to provide general information updates.

Public Meetings: The Navy conducts informal public meetings to keep residents and town officials informed about cleanup activities at NSB-NLON, and at significant milestones in the IR Program. Meetings are conducted to explain the findings of the RI; to explain the findings of the FS; and to present the Proposed Plan, which explains the preferred alternatives for cleaning up individual sites.

Fact Sheets and Information Updates: The Navy develops fact sheets to mail to public officials and other interested individuals and/or to use as handouts at the public meetings. Each fact sheet includes a schedule of upcoming meetings and other site activities. Fact sheets are used to explain certain actions or studies, to update readers on revised or new health risks, or to provide general information on the IR Program process.

Responsiveness Summary: The Responsiveness Summary for the Proposed Plan summarizes public concerns and issues raised during the public comment period and documents the Navy's formal

responses. The Responsiveness Summary may also summarize community issues raised during the course of the FS.

Announcement of the ROD: The Navy announces the signing of the ROD through a notice in actions or studies, to update readers on revised or new health risks, or to a major local newspaper of general circulation and a press release sent to everyone on the mailing list. The Navy places the signed ROD in the information repositories before any RAs begin.

Public Comment Periods: Public comment periods allow the public an opportunity to submit oral and written comments on the proposed cleanup options. Citizens have at least 30 days to comment on the Navy's preferred alternatives for cleanup actions as indicated in the Proposed Plan.

Technical Assistance Grant: A Technical Assistance Grant (TAG) from the EPA can provide up to \$50,000 to a community group to hire technical advisors to assist them in interpreting and commenting on site reports and proposed cleanup actions. Currently, no TAG funds have been awarded.

Site Tours: The Office of Public Affairs periodically conducts site tours for media representatives, local officials, and others.

A notice of availability of the Proposed Plan for Sites 3, 7, 14, 15, 18, and 20 groundwater (Navy, 2004a) was published on September 24, 2004 in The New London Day newspaper. The documents are available to the public in the NSB-NLON information repositories located at the Groton Public Library in Groton, Connecticut and the Bill Library in Ledyard, Connecticut. The notice also announced the start of the 30-day comment period that ended on October 24, 2004. A copy of the notice and the Proposed Plan are included in Appendix A of this ROD.

The notice invited the public to attend a public meeting held at the Best Western Olympic Inn in Groton, Connecticut on October 5, 2004. The public meeting presented the proposed remedies and solicited oral and written comments. At the public meeting, personnel from the Navy, EPA, and the CTDEP answered questions from the attendees during the informal portion of the meeting. In addition, public comments on the Proposed Plan were formally received and transcribed. The transcript for the public meeting is provided in Appendix B. Responses to the comments received during the public comment period are provided in the Responsiveness Summary in Section 3.0.

2.4 SCOPE AND ROLE OF OPERABLE UNIT

Sites 3, 7, 14, 15, 18, and 20 are six of 25 IR Program sites currently included in the NSB-NLON IR Program. As with many Superfund sites, the problems at these sites are complex. As a result, the media at Sites 3, 7, 14, 15, 18, and 20 have been separated into separate OUs as follows:

OU3: Includes Site 3 soil and sediment

OU6: Includes Site 15 soil

OU7: Includes Site 20 soil and sediment

OU8: Includes Sites 7 and 14 soil

OU9: All NSB-NLON groundwater in the upper base portions of NSB-NLON including the groundwater at Sites 3, 7, 14, 15, 18, and 20, which are included in this ROD, and the groundwater at Sites 2, 9, and 23.

OU11: Includes Sites 16 and 18 soil

A total of 12 OUs have been defined at NSB-NLON. The groundwater at Sites 3, 7, 14, 15, 18, and 20 is only a portion of the Basewide Groundwater OU9. The groundwater at the remaining sites in OU9 will be addressed in future decision documents. The interim remedies selected for Sites 3, 7, 14, 15, 18, and 20 groundwater are the first remedies for groundwater at these sites under CERCLA. These remedies will likely be the final remedies, but final remedies for OU9 will not be selected until interim actions have been selected for all portions of OU9. The remedies selected for Site 3 - NSA soil, Sites 7 and 14 soil, and Site 18 soil were documented in separate RODs (Navy, 2004b, 2004c, and 2004d). Site 15 soil (OU 6) was previously addressed by the Navy in a NFA Source Control ROD in 1997 (Navy, 1997b).

The Selected Remedy for Sites 3 and 7 groundwater will prevent potential unacceptable risks to human health and the environment associated with contaminants in the groundwater. The results of the risk assessments indicated no unacceptable risks to current receptors from exposure to groundwater at Sites 3 and 7, but exposure to maximum concentrations of contaminants at the sites could result in unacceptable risks to hypothetical future human receptors if they regularly consume the groundwater.

Evaluation of the available analytical data indicated no unacceptable health effects are anticipated from exposure to the groundwater at Sites 14, 15, 18, and 20; therefore, a NFA remedy was selected for the groundwater at these sites. Additional decision documents will be prepared for the remaining portions of OU9 as remedies are selected.

2.5 SITE CHARACTERISTICS

2.5.1 Physical Setting

2.5.1.1 Sites 3 and 14

Sites 3 and 14 are located within the lower portion of a northwest-trending valley (northern valley) situated between the topographic/bedrock high that occupies the central area of the NSB-NLON and the topographic/bedrock high that forms the northern border of the NSB-NLON. Figure 2-3 shows the topography and surface features of these sites. The northern valley is relatively narrow in the eastern portion of the site near the earthen dike, but it widens to the west.

Site 3 receives surface water and groundwater recharge from Site 2A, Site 2B, Site 7, Site 14, and surrounding areas. The streams within Site 3 convey the water to the Thames River. Site 14 is located adjacent to Stream 3.

There are relatively few buildings (Buildings 223, 281, 282, 376, 454, and 468) at Site 3. Most of these buildings are associated with the recreational area at North Lake and the golf course. A large portion of the site area is a golf course. Further development is not planned for this area because most of it is within designated ESQD arcs of Site 20.

The geology of Sites 3 and 14 consists of overburden deposits overlying metamorphic bedrock. The overburden consists of silty sand and gravel and is mapped as stratified drift of former meltwater streams [United States Geological Survey (USGS, 1960)]. Although these are natural materials, they have most likely been reworked in the area of the golf course. In general, the overburden thickness increases from the valley margins to the center of the valley and from southeast to northwest along the valley axis. The overburden thickness is less than 5 feet at well 2DMW10D and less than 15 feet at wells 2DMW25D and 2DMW27D. The overburden is thicker in the golf course area, and bedrock was not encountered in the 50-foot boring at well 2DMW26D. Well locations are shown on Figure 2-3.

The bedrock at Sites 3 and 14 has been identified as the Mamacoke Formation. The bedrock surface slopes from the northern and central bedrock highs that surround the area toward the northwest-trending valley. There appears to be a localized bedrock high at well 2DMW15D. The depth to bedrock is only 4 feet at this location, and the bedrock surface elevation is higher than was encountered in surrounding boreholes. This local bedrock high corresponds to a local topographic high within the valley. The boring logs for monitoring wells installed near OBDA indicate that the overburden locally consists of sand and boulders. The depth to bedrock at Site 3 was approximately 15 feet. There are bedrock exposures

upslope of Site 14, and bedrock was encountered at the site at depths of 12 feet below ground surface (bgs).

Groundwater is present in both the overburden and bedrock underlying Sites 3 and 14. The saturated thickness of the overburden ranges from a few feet along the valley margins to greater than 40 feet in the central portion of the stream valley. Depth to groundwater ranges from a few feet in the eastern portion to over 15 feet in the golf course area to the west. Figures 2-8 and 2-9 show regional groundwater flow patterns across Sites 3 and 14 in the shallow overburden and bedrock, respectively, based on the August 2000 round of water-level measurements taken during the BGOURI. Figures 2-10 and 2-11 show the local groundwater flow patterns in the shallow overburden and bedrock, respectively, based on October 2002 measurements. The figures show that groundwater flows from the topographic/bedrock highs and Site 2B to the site. From the downstream area, groundwater flows west toward and discharges into the Thames River. Vertical gradients between the overburden and bedrock are mixed across Site 3 but are predominantly upward. A downward gradient was observed at well cluster 2DMW24S/D, and upward head differentials were observed at well clusters 2DMW16S/D, 2DMW25S/D, and 2DMW28S/D.

Along the valley margins and near the Site 2B dike, local groundwater flow gradients are steep. As the bedrock slope flattens and the overburden thickens, the groundwater hydraulic gradients also flatten. The overall hydraulic gradient in the direction of groundwater flow across Site 3 within both the overburden and bedrock is approximately 0.024 based on the BGOURI 2000 water level data. In both the overburden and bedrock, the hydraulic gradient steepens slightly toward the Thames River.

Slug test results for Site 3 alluvium and bedrock wells, summarized in the BGOURI (TtNUS, 2002a), show that the average horizontal hydraulic conductivity of the alluvium is approximately 5.3 feet per day and that the average horizontal bulk hydraulic conductivity of the bedrock is approximately 1.8 feet per day. Using a flow gradient of 0.024, a hydraulic conductivity of 5.3 feet per day, and a measured porosity of 0.33, the average groundwater flow velocity through the predominantly sandy alluvial materials across Site 3 was calculated to be approximately 0.4 foot per day.

2.5.1.2 Site 7

Figure 2-4 shows the topography and surface features of Site 7. Site 7 is surrounded on the north and east by an exposed bedrock cliff. The cliff is the result of quarry activity along the northern bedrock high. The ground surface slopes gently to the southwest. There is an earthen berm along the eastern boundary of the site. Surface water runoff from Site 7 flows southwestward to drainage swales and storm sewers located on the southern side of Buildings 325 and 450. Runoff contained by the berm and the storm sewer system drains through culverts under Triton Road into Site 3 (Stream 5) and eventually into the Thames River.

The geology of Site 7 consists of a southwestward-thickening wedge of overburden materials overlying metamorphic bedrock. The surficial deposits underlying Site 7 consist of fill material that varies in thickness from 2 to 10 feet and consists primarily of sand and gravel. The fill either lies directly on bedrock (in the northeastern portion of the site) or is underlain by up to 30 feet of silty sand (along the southwestern edge of the site). This area has a history of quarrying and filling; therefore, the silty sand is natural alluvium. The bedrock in this area has been identified as the Mamcoke Formation. In the northeastern portion of the site, the bedrock surface is relatively flat and has a mild slope toward the southwest. The bedrock surface between groundwater monitoring wells 7MW1D and 7MW7S slopes at a grade of approximately 2 percent. The bedrock surface in this area has been altered by quarry activity. Overburden thickness is typically less than 6 feet in this area. Southwest of groundwater monitoring wells 7MW7S and 7MW2D and southeast of test boring 7TB10, the bedrock slopes to the west and southwest more steeply. The bedrock surface between groundwater monitoring wells 7MW7S and 7MW3D slopes at a steeper grade of approximately 14 percent. The overburden thickness increases to 30 to 40 feet in this area.

Groundwater was encountered in both the overburden and bedrock underlying Site 7. Depths to groundwater average less than 10 feet across the site. Within the overburden, the water table was generally encountered near the fill/alluvium interface at locations where both units were present. Figure 2-8 shows the overburden groundwater flow pattern across the Site 7 area based on August 2000 water level data. The figure shows that the general direction of shallow groundwater flow is to the west-southwest toward Site 3. Groundwater flow directions in the shallow bedrock, as determined during the BGOURI, are to the west and southwest (Figure 2-9). In the overburden, the hydraulic gradient across the site is approximately 0.02. Within the bedrock, the flow gradient appears to be slightly lower at 0.015.

Downward vertical gradients were consistently observed at Site 7. Groundwater monitoring well clusters 7MW2S/2D (alluvium/bedrock), 7MW3S/3D (combined fill and alluvium/deep alluvium), and 7MW5S/5D (combined overburden and bedrock/deeper bedrock) all had downward vertical gradients, indicating that the Site 7 area is a local recharge area for groundwater.

Slug tests were performed in three alluvium and two bedrock wells at Site 7 over the course of the various RI field investigations. The estimated site-specific average hydraulic conductivity for the alluvium, based on the slug test results, is 11.4 feet per day. Using a hydraulic gradient of 0.02 and a measured porosity of 0.37, the estimated groundwater seepage velocity in the alluvium at the site is 0.62 foot per day.

2.5.1.3 Site 15

Figure 2-5 shows the surface features of Site 15. The entire area is covered with concrete or bituminous pavement. The site is located southwest of the central bedrock high, which narrowly extends to the south. The ground surface in the vicinity of the site and southwest is relatively flat.

Surface water runoff from this site is collected by a storm sewer system. The storm sewer system passes through the Tank Farm (Site 23) and Goss Cove Landfill (Site 8) sites and eventually discharges to the Thames River.

Geologic conditions at Site 15 consist of variable thicknesses of fill and natural alluvial deposits overlying metamorphic bedrock. The overburden at Site 15 consists primarily of silty sand alluvium. Boring logs indicate that in some intervals, there are traces of clay and in others, there are traces of gravel and rock fragments. Site 15 has been mapped as stratified drift deposited by glacial meltwater streams (USGS, 1960). Minor thicknesses of fill may be present overlying the silty sand in some areas of the site. The borings for wells 15MW1D and 15MW4S encountered silt layers of 26- and 24-foot thicknesses, respectively, beneath the silty sand interval. These deposits are also most likely stratified drift.

The bedrock surface slopes to the southwest across the site. Monitoring well 15MW1D was drilled to a depth of 46.5 feet below ground surface (bgs), where gneiss fragments of the Mamacoke Formation were encountered. Monitoring well 15MW4S was drilled to a total depth of 43 feet bgs. Bedrock was not positively identified in this boring; however, auger refusal was reached, suggesting that the bedrock surface may have been encountered. Northeast of the site along Rasher Avenue, bedrock crops out at ground surface.

During historic and recent investigations at this site, groundwater was encountered in the alluvium at depths of less than 10 feet bgs. Most overburden groundwater flow is expected to be through the silty sand layer, with the underlying silt deposit acting as a semi-confining unit. The groundwater generally flows to the south-southwest. There is a downward vertical gradient at the 15MW1 well cluster.

Water level measurements were taken in Site 15 monitoring wells during the BGOURI in 2000. The elevations were used in conjunction with water level data from other sites to create regional shallow overburden and bedrock potentiometric surface maps (see Figures 2-12 and 2-13, respectively). Water level measurements were also taken in Site 15 monitoring wells during a DGI in 2002. These data were used to prepare a site-specific potentiometric surface map for the shallow overburden groundwater at Site 15 (see Figure 2-14). Based on a comparison of Figures 2-12 and 2-14, it can be seen that the groundwater flow direction (southwest) in the shallow overburden groundwater was consistent during both rounds.

Based on information presented in the BGOURI Report (TtNUS, 2002a), the hydraulic gradient in shallow overburden across the site is approximately 0.024. During the Phase II RI field work, slug tests were performed in wells 15MW1S and 15MW3S. The geometric mean of the calculated hydraulic conductivities is 0.76 feet per day. Assuming a porosity of 0.30, the estimated groundwater seepage velocity at Site 15 is 0.06 feet per day.

2.5.1.4 Site 18

Figure 2-6 shows the surface features of Site 18. The site is located north of Site 15 and Site 23. A steep embankment exists on the northern and eastern sides of Building 33. The embankment slopes at an approximate gradient of 50 percent toward the south and west. The gradient flattens to approximately 5 percent on the southern and eastern sides of Building 33.

Surface water runoff from this site is collected by a storm sewer system. The storm sewer system passes through Site 23 and Site 8 and eventually discharges to the Thames River.

The SCS Soils Map (SCS, 1983) classifies the soil on the southern and western sides of Building 33 as Urban land. Upgradient of the site (north and east), bedrock exposures (Hollis-Charlton-Rock outcrop complex) are prevalent as the central bedrock high extends toward the south. The soils overlying the bedrock range from very stony fine sandy loam to gravelly loam.

Minimal subsurface investigation work has been performed at Site 18. The site has a veneer of silty sand overlying shallow metamorphic bedrock. The sand is fine to medium grained and contains trace to some gravel and rock fragments.

Groundwater levels were measured in temporary wells 18TW2 and 18TW4 on June 14, 2000. The elevations associated with these measurements are presented on Figure 2-6. The general direction of groundwater flow in the shallow overburden at Site 18 is to the south. Groundwater from this site will eventually discharge to the Thames River. The saturated thickness of the overburden at the site varies from approximately 1 foot to greater than 5 feet.

2.5.1.5 Site 20

Site 20 is located along the southern side of the northern topographic and bedrock high (see Figure 2-7). The ground surface generally slopes from the northern bedrock high across the site to the south toward the Site 2B. The ground surface across Site 20 was altered (flattened) when the bedrock was blasted

during construction of Building 524. To the west and southwest, the ground surface slopes to a ravine (Site 3) and toward Site 14.

Two drainage culverts (one along the northwestern side and one along the southeastern side of the site) collect runoff from the surrounding hillsides and from Site 20 and discharge it to Site 2B. The drainage culvert along the northwestern side eventually discharges to a storm sewer that passes along the southern side of the site and discharges into Site 2B. The drainage culvert along the southeastern side collects runoff from the hillside north of the site and continues along the southeastern side of the site, eventually discharging to another area of Site 2B. Site 2B discharges to Site 3 and subsequently into the Thames River. Water typically flows in these drainage culverts immediately following precipitation events.

The overburden materials at Site 20 consist of 4 to 16 feet of coarse sand, gravel, and rock fill underlain by up to 17 feet of fine-grained dredge spoils. Test borings showed that 4 to 8 feet of fill material rests directly on bedrock (Mamacoke Formation) across Site 20. The overburden thickness generally increases to the south and east, toward the Site 2B.

The bedrock surface generally slopes to the southwest across the site, toward the valley occupied by Site 2. Bedrock elevations in the Site 20 area indicate that the bedrock surface does not slope uniformly and that localized bedrock surface depression(s) are present. The depressions are most likely the result of the blasting activities that occurred during the construction of Building 524.

Groundwater is present in both the overburden and bedrock underlying Site 20. The saturated thickness of the overburden deposits is variable, ranging up to 25 feet or more. Overburden groundwater is primarily found within the dredge spoil materials, and only the lowermost few feet of the coarser-grained fill deposits are saturated. Shallow overburden and bedrock groundwater contours for Site 20 and nearby areas, based on August 2000 water levels, are shown on Figures 2-8 and 2-9, respectively. Groundwater in both the overburden and bedrock at Site 20 flows to the west and southwest. Shallow overburden groundwater contours at Site 20 generated from water levels measured during the October 2002 DGI are shown on Figure 2-15. The site-specific contours and groundwater flow directions are generally similar to those measured in 2000.

The hydraulic gradient in the shallow overburden varies considerably across Site 20; it is steeper in the area of Building 524 and flatter at the storage bunkers near the Area A Wetlands. The overall groundwater flow gradient in the overburden, based on the 2000 water level data, averages approximately 0.04. Assuming an average horizontal hydraulic conductivity of dredge spoil of 0.017 foot per day and alluvium/fill of 2.0 feet per day (based on hydraulic testing completed at Site 2A) and a

porosity of 0.30, the horizontal seepage velocity for overburden groundwater in this area ranges from approximately 0.0023 to 0.27 foot per day.

2.5.2 Nature and Extent of Contamination

The Navy conducted various field investigations at Sites 3, 7, 14, 15, and 20 from 1990 to 2002 to assess the nature and extent of groundwater contamination. The investigations at Sites 3, 7, and 20 focused on the groundwater present in the overburden and bedrock, and the investigation at Site 14 only focused on the groundwater in the overburden. Sites 14 and 20 are located hydraulically upgradient of Sites 3 and 7.

Only one round of investigation was conducted at Site 18 to assess the nature and extent of contamination. The investigation focused on the groundwater present in the overburden.

2.5.2.1 Sites 3 and 14

The groundwater at Sites 3 and 14 was investigated independently and collectively throughout the various investigations. The nature and extent of contamination found during each investigation is discussed below.

Phase II RI

Site 3 - Overburden

Seven VOCs, including six halogenated aliphatics and benzene, were detected in the groundwater samples collected from the overburden wells at Site 3. Each VOC was detected in from 1 to 3 of 25 samples. Most of the positive results were associated with samples collected from well 2DMW29S, located along Triton Road in the north-central portion of the site. Maximum concentrations of total 1,2-dichloroethene [28 micrograms per liter ($\mu\text{g/L}$)], bromodichloromethane (2 $\mu\text{g/L}$), chloroform (12 $\mu\text{g/L}$), methylene chloride (11 $\mu\text{g/L}$), and vinyl chloride (VC) (130 $\mu\text{g/L}$) were detected in samples from this well. None of these chemicals were identified in the surface water samples collected from the adjacent drainageway (Stream 5) along Triton Road. The source(s) of the groundwater contamination is not known.

Two phthalate esters (plasticizers that are common field and laboratory contaminants) and benzoic acid were each detected in from one to three of the groundwater samples collected from overburden wells. Neither pesticides nor polychlorinated biphenyls (PCBs) were detected in groundwater samples collected from the overburden wells.

Twenty-three metals were detected in unfiltered groundwater samples collected from the overburden wells, and 19 metals were detected in the associated filtered groundwater samples. Greater than two-thirds of the maximum concentrations of metals were associated with samples collected from overburden wells 2DMW30S and 3MW12S. Notable results for metals included maximum concentrations of aluminum (97,400 µg/L), arsenic (23.9 µg/L), barium (835 µg/L), manganese (6,710 µg/L), vanadium (229 µg/L), and zinc (800 µg/L).

Site 3 - Bedrock

Five halogenated aliphatics (1,1,2,2-tetrachloroethane, total 1,2-dichloroethene, chloroform, methylene chloride, and TCE) were detected in groundwater samples collected from bedrock wells at Site 3. Each VOC was detected in from 1 to 4 of the 25 groundwater samples. TCE concentrations ranged from 1 µg/L to 17 µg/L. Maximum concentrations of 1,1,2,2 tetrachloroethane, total 1,2-dichloroethene, and TCE were detected in the groundwater sample collected from well 2DMW16D, located approximately 125 feet southeast of North Lake, during the Phase I RI.

Eleven semivolatile organic compounds (SVOCs) were also detected in groundwater samples from Site 3 bedrock wells. Six PAHs, ranging in concentration from 1 µg/L to 4 µg/L, were detected in the groundwater sample from well 3MW12D collected during Round 1 of the Phase II RI. In addition, bis(2-ethylhexyl)phthalate was detected in five groundwater samples at concentrations ranging from 2 µg/L to 20 µg/L. Two additional phthalates, benzoic acid, and phenol were each detected in one or two groundwater samples at concentrations ranging from 0.5 µg/L to 5 µg/L. As previously noted, phthalates are considered to be common laboratory contaminants. Neither pesticides nor PCBs were detected in any of the groundwater samples.

Twenty-two metals were detected in unfiltered groundwater samples collected from the bedrock wells and 18 metals were detected in the associated filtered groundwater samples. Approximately 42 percent of the maximum concentrations of metals were associated with samples collected from bedrock well 3MW12D.

Site 14 - Overburden

Only one VOC (carbon disulfide) and one SVOC [bis(2-ethylhexyl)phthalate] were detected in the two groundwater samples collected from well 14MW1S. Both chemicals were detected at an estimated concentration of 1 µg/L. The results indicate that Site 14 is not a significant source of organic groundwater contamination.

Eleven metals were detected in the unfiltered Site 14 groundwater samples, and 12 metals were detected in the associated filtered groundwater samples. With the exception of aluminum (detected at a

concentration of 171 µg/L in unfiltered sample 14GW1S only), there were no significant differences between filtered and unfiltered metals results (i.e., filtered and unfiltered results for the remaining metals were at the same order of magnitude). Maximum concentrations of arsenic in filtered samples and of boron and cobalt in unfiltered samples exceeded respective concentrations of these metals detected in the unfiltered groundwater samples collected from the off-site residential wells.

BGOURI

Sites 3 and 14 - Overburden

Four VOCs (chloroform, cis-1,2-dichloroethene, TCE, and VC) were detected in one or more of the 10 groundwater samples collected from the overburden aquifer. Detected concentrations of these VOCs ranged from 1.71 µg/L (cis-1,2-dichloroethene) to 31.3 µg/L (VC). Chloroform, 1,2-dichloroethene (total), and VC were also detected in overburden groundwater samples collected during previous investigations. Concentrations of these chemicals were lower in the samples collected during the BGOURI than in samples collected during the previous investigations.

Acetone was detected at concentrations of 27.8 J µg/L and 28.9 J µg/L in two samples collected from temporary wells installed in the overburden aquifer. VC (4.65 µg/L) and cis-1,2-dichloroethene (1.71 µg/L) were detected in one groundwater sample collected from a temporary well.

Several PAHs and 4-methylphenol were the only SVOCs detected in groundwater at Site 3. Concentrations of most of these SVOCs were low, ranging from 0.03 J µg/L [benzo(k)fluoranthene] to 2 J µg/L (4-methylphenol). With the exception of fluoranthene, which was detected in three groundwater samples, each of the detected SVOCs was only found in one groundwater sample. PAHs and 4-methylphenol were not detected in overburden groundwater samples collected during previous investigations.

Trace levels of 1,1-dichloro-2,2-bis(4-chlorophenyl)ethane (DDD) (0.019 J µg/L) and 1,1,1-trichloro-2,2-bis(4-chlorophenyl)ethane (DDT) (0.034 J µg/L) were the only pesticides detected in groundwater from the overburden aquifer at Site 3. These compounds were only detected in the sample collected from monitoring well 2DMW30S. High levels of total suspended solids were measured in this well and are the likely cause of the detections of DDD and DDT in groundwater. Pesticides were not detected in overburden groundwater samples collected during previous investigations.

Fifteen metals were detected in unfiltered overburden groundwater samples, and nine metals were detected in filtered overburden groundwater samples. Reported concentrations of metals in filtered and unfiltered samples were relatively similar (i.e., at the same order of magnitude). In general, the detected

concentrations of metals were low. Concentrations of all metals were lower in groundwater samples collected during the BGOURI than in samples collected during previous investigations.

Site 3 - Bedrock

Three VOCs (chloroform, cis-1,2-dichloroethene, and TCE) were detected in nine groundwater samples collected from the bedrock aquifer. TCE concentrations were low, ranging from 1.88 µg/L to 8.76 µg/L. In general VOCs were detected infrequently in bedrock groundwater during the BGOURI. Chloroform, 1,2-dichloroethene (total), and TCE were also detected in bedrock groundwater samples collected during previous investigations. Concentrations of 1,2-dichloroethene and TCE detected during the BGOURI were lower than concentrations detected during previous investigations.

No SVOCs, pesticides, or PCBs were detected in groundwater samples collected from the bedrock aquifer.

Fourteen metals were detected in unfiltered bedrock groundwater samples, and eight metals were detected in filtered bedrock groundwater samples. Reported concentrations of metals in filtered and unfiltered samples were relatively similar (i.e., at the same order of magnitude). In general, the detected concentrations of metals were low. Concentrations of all metals were lower in groundwater samples collected during the BGOURI than in samples collected during previous investigations, with the exception of silver and zinc.

BGOURI Update/FS

Additional groundwater samples were collected from Site 3 during the 2002 DGI and analyzed to further define the nature and extent of contamination at the site. A portion of the groundwater sampling program was concentrated on determining the overall nature and extent of contamination at the NSA at Site 3. Petroleum contamination was expected in this area based on information collected during the remediation of Stream 5. Groundwater samples were collected from three new temporary wells installed in the overburden and analyzed for TCL VOCs, SVOCs, pesticides, and PCBs and total and dissolved TAL inorganics. The remaining portion of the groundwater sampling program was focused on confirming the nature and magnitude of the groundwater contamination identified during the BGOURI. Five groundwater samples were collected from existing permanent monitoring wells (three overburden and two bedrock) and analyzed for TCL VOCs and PAHs, and arsenic. Table 2-1 summarizes the results for the chemicals that were positively detected in the DGI groundwater samples. Tables 2-2 and 2-3 provide frequency of detection information for DGI groundwater results and screen the data against direct exposure and migration criteria, respectively. The nature and extent of contamination discussion provided below is

based on the combined set of analytical data collected during the DGI and does not differentiate between geologic units (overburden or bedrock).

Eight VOCs were detected in the groundwater samples collected during the DGI. 1,1,2-Trichloroethane, carbon disulfide, toluene, and trans-1,2-dichloroethene were detected during the DGI, but were not detected during the BGOURI. These VOCs were detected infrequently (less than 25 percent of the samples) and at relatively low concentrations (less than 2 µg/L). Maximum concentrations of 1,1,2-trichloroethane, toluene, and trans-1,2-dichloroethene were detected in temporary wells 3TW27 and 3TW28. Carbon disulfide was detected only in well 2DMW23D. The maximum concentration of chloroform was also found in this well. The compounds cis-1,2-dichloroethene, TCE, and VC were detected at lower concentrations (less than 3 µg/L) during the DGI than the BGOURI (less than 32 µg/L). These three VOCs were detected only in permanent overburden monitoring wells 2DMW29S and 2DMW30S and temporary wells 3TW27 and 3TW28. All of these wells are located along Stream 5 in the northern portion of Site 3.

Chlorinated VOCs have been consistently detected in several Site 3 wells since the Phase II RI. The source of the VOCs detected in groundwater may have been the NSA at Site 3; however, no significant concentrations of VOCs were found in the soil samples collected from the NSA during the DGI. A historic upgradient potential source, such as the leach fields at Site 7, may also have been the source of the VOCs. Table 2-4 summarizes the trends of TCE and its degradation compounds in select Site 3 monitoring wells as well as in select Site 6 and Site 7 monitoring wells, which are located downgradient and upgradient, respectively, of Site 3. Based on a review of the contaminant information along with hydrogeologic information, it appears that the original conceptual model of contaminant release and migration was correct. It appears that VOC contamination (TCE) was originally released in the Site 7 area (leach fields) and migrated to Site 3. There are VOC detections along the length of Stream 5 from Site 7 to the Thames River. Low concentrations of TCE were also detected in 2000 along the southern side of Site 3 near Streams 1 and 6. Residual TCE contamination was detected in Site 7 groundwater in 2000. Both cis-1,2-dichloroethene and VC, degradation products from the dechlorination of TCE, have been detected in 2DMW29S since 1994. Concentrations of VC in 2DMW29S have decreased significantly from 130 µg/L (Phase II RI in 1994) to 0.3 µg/L (DGI in 2002). These data suggest that this may be the tail end of the plume and that natural degradation is occurring. Further downgradient along Stream 5, consistent concentrations of TCE and cis-1,2-dichloroethene have been detected in monitoring well 6MW6D since 1998 under the Site 6 groundwater monitoring program. TCE has also been consistently detected in shallow well 6WM6S since 1999. Wells 6MW6S and 6MW6D are located upgradient of the DRMO and are actually located just inside the western boundary of Site 3. The results from the wells reflect contaminant levels exiting Site 3. TCE and cis-1,2-dichloroethene have also been detected in monitoring wells 6MW1S and 6MW2S, which are located adjacent to the Thames River. This

information indicates that the leading edge of the low concentration plume has already migrated to the Thames River.

Seven SVOCs, all PAHs, were infrequently detected in the groundwater samples collected during the DGI. No PAHs were detected in the samples collected from the permanent monitoring wells. All of the maximum concentrations of PAHs were less than 1 µg/L and were detected in 3TW28. The source of the detected PAHs may be the PAH-contaminated soil [i.e., slightly high turbidity, 18 nephelometric turbidity units (NTUs)/suspended solids in the temporary well] or the petroleum hydrocarbon contamination associated with the NSA.

The only pesticides detected in groundwater were alpha- and beta-BHC, and they were detected only in the groundwater sample from 3TW28. These pesticides were detected at low concentrations in soil samples, but it is unlikely that they have leached at significant dissolved concentrations to the groundwater. It is more likely that because 3TW28 is a temporary well, these groundwater detections were the result of suspended solids incorporated into the groundwater sample during sampling.

No PCBs were detected in the groundwater samples.

Thirteen inorganics were detected in the unfiltered samples collected during the DGI, but only eight inorganics were detected in the filtered samples. Aluminum, chromium, copper, lead, and vanadium were the inorganics detected in the unfiltered samples but not the filtered samples. It is likely that the detections of these inorganics are related to suspended solids incorporated into the groundwater samples from these temporary wells. A significant total concentration of arsenic was found in permanent monitoring well 2DMW29S (25.4 µg/L), but the dissolved arsenic concentration from the same well was 3.5 µg/L, only slightly greater than the background level (2.55 µg/L). This information also suggests that suspended solids caused the total arsenic concentration to be artificially high. Overall, the data indicate that the at Site 3 - NSA is not a significant source of inorganic contamination.

The groundwater at the Area A Landfill, which is located hydraulically upgradient of Site 3, has also been monitored as part of a long-term groundwater monitoring program. The monitoring results do not indicate that the Area A Landfill is acting as a significant source of contamination to Site 3 groundwater or surface water.

2.5.2.2 Site 7

Historic Investigations (Combined Results of Phase I and II RIs)

Overburden

Eight VOCs, including six chlorinated aliphatics, 2-butanone, and carbon disulfide, were detected in groundwater samples collected from Site 7 overburden wells. 1,1,1-Trichloroethane and 1,1-dichloroethane were each detected in 6 of 20 groundwater samples, at concentrations ranging from 2 µg/L to 42 µg/L. 1,1-Dichloroethene was detected in four groundwater samples at concentrations ranging from 1 µg/L to 2 µg/L. The remaining VOCs were detected in one or two samples at concentrations ranging from 1 µg/L to 10 µg/L. Maximum concentrations of all VOCs except 2-butanone, chlorobenzene (CB), and methylene chloride were associated with the sample collected from well 7MW3S, located west of Building 325 in the south leach field.

Thirteen SVOCs, including six PAHs, three phthalates, 1,4-dichlorobenzene (1,4-DCB), benzoic acid, dibenzofuran, and phenol, were detected in the 20 groundwater samples collected from overburden wells at Site 7. Benzoic acid and di-n-butyl phthalate were detected in six and four samples, respectively. The remaining SVOCs were each detected in only 1 or 2 of 20 samples. With the exception of bis(2-ethylhexyl)phthalate, which was detected in a single groundwater sample at a concentration of 380 µg/L, all SVOC concentrations ranged from 0.5 µg/L to 9 µg/L. Maximum concentrations of eight SVOCs were associated with groundwater samples collected from well 7MW8S, located along Triton Road in the western portion of the site.

The two groundwater samples collected during the Phase I RI were analyzed for pesticides and PCBs. Neither pesticides nor PCBs were detected in either of these samples.

Twenty-two metals were detected in unfiltered groundwater samples collected from the overburden wells, and 15 metals were detected in the corresponding filtered groundwater samples. In general, maximum concentrations reported for metals in unfiltered and filtered samples were relatively similar (i.e., at the same order of magnitude). Close to half of the maximum concentrations of metals were associated with groundwater samples collected from well 7MW3D, located near Triton Road and west of the south leach field. Notable results included the maximum concentrations reported for antimony (108 µg/L), manganese (1,780 µg/L), and silver (38.9 µg/L).

Analyses for oil and grease were performed on four of the groundwater samples. The sample from well 7MW3D had an oil and grease a concentration of 600 µg/L. TPH analyses were performed for nine of the groundwater samples collected from overburden wells. TPH was detected in two samples (both collected

from well 7MW8S) at concentrations of 700 µg/L and 1200 µg/L. This well is located along Triton Road, downgradient of the three buildings.

Bedrock

Minimal organic contamination was detected in the groundwater samples collected from the Torpedo Shops bedrock wells. 1,1,1-Trichloroethane (2 µg/L), methylene chloride (1 µg/L), benzoic acid (0.7 µg/L), and phenol (0.8 µg/L) were detected in samples collected from well 7MW5D. Single detections of 4-methyl-2-pentanone, methylene chloride, and total xylenes were found in groundwater samples collected from three Site 7 wells. No other VOCs, SVOCs, pesticides, or PCBs were detected in the groundwater samples collected from Torpedo Shops bedrock wells.

Twenty-four metals were detected in unfiltered groundwater samples collected from the bedrock wells, and 14 metals were detected in the corresponding filtered groundwater samples. Maximum concentrations reported for barium, copper, iron, lead, and zinc in unfiltered samples were more than five times greater than maximum concentrations of respective metals reported for filtered samples. This indicates that concentrations of these metals in the unfiltered samples may be caused by the presence of suspended sediments and may not actually represent contamination of the groundwater. More than half of the maximum concentrations of metals were associated with groundwater samples collected from well 7MW5D, located near the southwestern corner of Building 450. In addition, several maximum concentrations were associated with groundwater samples collected from well 7MW4S, located near the southeastern corner of Building 325.

BGOURI

Tables 2-5 and 2-6 summarize the results for the chemicals that were positively detected in the temporary and permanent monitoring wells, respectively, that were sampled at Site 7 during the BGOURI. Tables 2-7 and 2-8 provide frequency of detection information for BGOURI groundwater results and screen the data against direct exposure and migration criteria, respectively.

Overburden – Temporary Wells

1,4-DCB, benzene, and CB were the only VOCs detected in the 10 temporary monitoring wells. 1,4-DCB was detected in samples S7TW0801, S7TW0901, and S7TW1001 at concentrations of 1.83 µg/L, 9.21 µg/L, and 90.5 µg/L, respectively. Benzene was detected in only sample S7TW1001 at a concentration of 2 µg/L. CB was detected in samples S7TW0901 and S7TW1001 at concentrations of 6.66 µg/L and 165 µg/L, respectively. Based on the locations of the wells (see Figure 2-4), it is likely that

these contaminant detections are related to the septic tank located along the western side of Building 325. The septic system is no longer used, but the disposition of the tank is not known.

Three of the 10 temporary monitoring wells were analyzed for SVOCs. The only SVOC detected in the temporary monitoring wells was bis(2-ethylhexyl)phthalate, which was detected in samples S7TW0801 and S7TW0901 at concentrations of 44 µg/L and 49 µg/L, respectively.

Seventeen metals were detected in the groundwater samples collected from Site 7 temporary monitoring wells. Maximum detected concentrations of all these metals were found in S7TW0901. Arsenic, barium, chromium, cobalt, copper, nickel, silver, vanadium, and zinc were detected in only S7TW0901. Calcium, magnesium, manganese, potassium, and sodium were detected in all three samples. Aluminum, iron, and lead were detected in two of three samples. Of these detected metals, aluminum, arsenic, barium, chromium, iron, lead, nickel, silver, vanadium, and zinc were detected at concentrations in excess of background concentrations. The total suspended solids content in sample S7TW0901 was two orders of magnitude higher than in the other two samples; this may account for the elevated levels of metals in this sample.

Overburden – Permanent Monitoring Wells

1,3-DCB, 1,4-DCB, and TCE were the only VOCs detected in the 13 permanent overburden monitoring wells at Site 7. 1,3-DCB and 1,4-DCB were detected only in S7MW03S01 at 2 µg/L. TCE was detected in S7B325MW0101, S7B325MW0301, S7MW07S01, and S7MW09S01 at concentrations of 1.93 µg/L, 1.39 µg/L, 2.03 µg/L, and 23 µg/L, respectively.

The only SVOCs detected in these 13 monitoring wells were bis(2-ethylhexyl)phthalate, fluorene, hexachlorobenzene (HCB), and phenanthrene. Phenanthrene and bis(2-ethylhexyl)phthalate were detected in only sample S7MW08S01, at concentrations of 6.5 µg/L and 190 µg/L, respectively. HCB was detected only in sample S7MW09S01 at a concentration of 3 µg/L. Fluorene was detected in samples S7MW05S01 and S7MW08S01 at concentrations of 0.26 µg/L and 6.5 µg/L, respectively.

Seventeen inorganics were detected in the unfiltered groundwater samples collected from Site 7 permanent bedrock monitoring wells. Maximum detected concentrations of these metals were scattered among the 13 wells. Arsenic, cadmium, chromium, selenium, and vanadium were detected in only 1 of 13 samples. Aluminum, copper, iron, and lead were detected in from 4 to 5 of 13 samples. Barium, cobalt, and zinc were detected in 8 of 13 samples. Manganese was detected in 11 of 13 samples. Calcium, magnesium, potassium, and sodium were detected in all 13 samples. Of these detected metals, arsenic, cadmium, lead, selenium, and zinc were detected at concentrations in excess of background concentrations. In addition, arsenic, which was detected at a concentration of 2.9 µg/L, is in excess of

direct contact criteria but not in excess of CTDEP pollutant mobility criteria (CTDEP, 1996). Zinc, which was detected at a maximum concentration of 194 µg/L, was the only analyte present at a concentration in excess of CTDEP pollutant mobility criteria.

The field duplicate pair (S7MW10S01-F and S7MW10S01-F-D) was filtered and analyzed for dissolved metals. Barium, calcium, copper, magnesium, potassium, sodium, and zinc were detected in this field duplicate pair. Concentrations of these metals were all less than background concentrations, direct contact criteria, and CTDEP pollutant mobility criteria. Concentrations of barium and copper were greater in the filtered samples than in the unfiltered samples. Concentrations of the remaining metals were similar in both the total and dissolved analyses.

Bedrock – Permanent Wells

TCE was the only VOC detected in the four Site 7 bedrock groundwater samples collected. TCE was detected in samples S7MW01D01, S7MW02D01, and S7MW05D01 at concentrations of 4.09 µg/L, 1.54 µg/L, and 7.58 µg/L, respectively, which are all in excess of the direct contact criterion but less than the CTDEP pollutant mobility criterion. TCE was also detected in overburden groundwater samples.

No semivolatiles were detected in the bedrock groundwater samples at Site 7.

Eleven metals were detected in the unfiltered groundwater samples collected from the bedrock aquifer at Site 7. The majority of the maximum concentrations of these 11 metals were detected in samples S7MW03D01 and S7MW05D01. Calcium, magnesium, potassium, and sodium were the only metals detected in all four bedrock groundwater samples. Copper and nickel were only detected in sample S7MW05D01. The remaining detected metals were present in from two to three of the four samples collected. The concentrations of lead, nickel, and zinc were in excess of background concentrations. The total dissolved solids and total suspended solids concentrations in samples S7MW03D01 and S7MW05D01 were similar and were higher than those of the other two bedrock monitoring wells.

Sample S7MW01D01-F was filtered and analyzed for dissolved metals. Calcium, magnesium, manganese, potassium, sodium, and zinc were the only metals detected in this sample. The concentrations of these dissolved metals were similar to those detected in the total metals analysis of this sample and were all less than background concentrations.

2.5.2.3 Site 15

The Site 15 groundwater results from the Phase II RI, BGOURI, and BGOURI Update/FS are summarized below. Detailed summaries of the associated data were presented in the historical reports. Figure 2-3 shows Site 15 sample locations.

A Source Control ROD for the soil at Site 15 (OU6) was previously signed in 1997. However, because the groundwater results from the BGOURI indicated that a potential source of contamination may have still existed in the soil, additional soil samples were collected during a DGI and evaluated in the BGOURI Update/FS. The DGI results showed that there is no contamination remaining in the soil that is acting as a source of contamination to the groundwater.

Phase II RI

A total of 10 groundwater samples were collected from five overburden wells at Site 15 during Rounds 1 and 2 of the Phase II RI in 1994. Carbon disulfide was detected at a concentration of 3 µg/L in the groundwater sample collected from well 15MW1D during Round 1 of the Phase II RI. No other VOCs were detected. Five SVOCs [1,4-dichlorobenzene, bis(2-ethylhexyl)phthalate, di-n-butyl phthalate, naphthalene, and phenanthrene] were detected in the groundwater samples. The two phthalates, plasticizers that are common field and laboratory contaminants, were each detected in 4 of the 10 samples. The remaining SVOCs were each detected in 1 or 2 of the 10 samples. Concentrations of bis(2-ethylhexyl)phthalate ranged from 0.6 µg/L to 45 µg/L. Concentrations of the remaining SVOCs detected in the Site 15 groundwater samples ranged from 0.5 µg/L to 1 µg/L. A single pesticide, heptachlor, was also detected in a groundwater sample at a concentration of 0.54 µg/L.

Twenty-one metals were detected in the unfiltered groundwater samples collected from Site 15 wells, and 17 metals were detected in the corresponding filtered groundwater samples. A majority of the maximum concentrations were associated with samples collected from wells 15MW3S and 15MW2S, located downgradient and upgradient, respectively, of Site 15. Notable results reported for Site 15 groundwater samples include maximum concentrations of manganese in both filtered and unfiltered groundwater samples at 3,080 µg/L and maximum concentrations of zinc in filtered and unfiltered groundwater samples at 450 µg/L and 453 µg/L, respectively. The maximum lead concentration in one unfiltered groundwater sample from 15MW3S (21.2 µg/L) was significantly higher than subsequent filtered (2 µg/L) and unfiltered (4.4 µg/L) samples collected from the same well.

BGOURI

Four additional groundwater samples were collected at Site 15 during the BGOURI in 2000. TCE, the only VOC detected during the BGOURI, was not detected in groundwater at this site during previous sampling events. TCE was detected in three of four groundwater samples at concentrations ranging from 2.32 J µg/L (15MW2S) to 16 µg/L (15MW3S). The source of the TCE was unknown. TCE was not detected in any Site 23 groundwater samples; therefore, it did not appear that the TCE is migrating to downgradient locations at significant concentrations.

Anthracene, fluoranthene, and pyrene were detected in sample S15MW3S01 at concentrations less than 100 µg/L. None of these SVOCs were detected in groundwater samples collected during the Phase II RI.

Fifteen inorganics were detected in the groundwater samples collected from Site 15. Seven of the 15 detected metals were present in all four samples. Significant concentrations of metals were detected most frequently in samples from wells 15MW1S and 15MW2S. Cadmium, chromium, lead, nickel, and silver were detected at elevated concentrations. Lead was the only inorganic detected at significant levels during both the Phase II RI and BGOURI. Chromium and lead were detected in all four BGOURI samples.

Cadmium was detected in sample 15MW1S01 at a concentration of 0.99 µg/L and in sample 15MW2S01 at a concentration of 3.4 µg/L. Chromium concentrations ranged from 7.9 µg/L to 121 µg/L. Nickel was detected only in sample 15MW1S01 at a concentration of 77.6 µg/L. The nickel concentration in the adjacent, deep overburden well 15MW1D was not elevated.

Lead was detected at concentrations less than direct contact screening criteria in all samples except in 15MW1S01 (24.7 µg/L). Lead concentrations exceeded the background concentration in samples 15MW1S01 and 15MW2S01. The groundwater in 15MW2S was acidic (pH = 4.44), the groundwater in 15MW1S and 15MW3S was slightly acidic (pH = 5.75 and 5.91, respectively), and the groundwater in 15MW1D was near neutral (pH = 6.9). Lead was detected at 2.8 J µg/L in the deep overburden aquifer well 15MW1D. The pH data and the detected concentrations of lead indicate that residual contamination from the former SASDA is impacting the shallow overburden groundwater.

Silver was detected in 3 of 3 samples at concentrations ranging from 79.1 µg/L (15MW1D) to 615 µg/L (15MW2S). The maximum silver concentration was found in well 15MW2S, which also had the lowest pH (4.44). Concentrations of silver decrease in the downgradient direction, but the existing monitoring well network at Site 15 does not extend far enough downgradient to fully define the most downgradient extent of silver in groundwater. Even though the monitoring well network is limited at Site 15, silver was not

detected in any downgradient groundwater samples at Site 23. Therefore, it does not appear that silver is migrating to downgradient locations at significant concentrations.

Of the 10 remaining detected metals, concentrations of aluminum, beryllium, and zinc were in excess of background concentrations.

BGOURI Update/FS

Additional groundwater samples were collected at Site 15 during a DGI in 2002 and analyzed to further define the nature and extent of contamination at the site. The sampling program was focused on the groundwater contaminants, including TCE, chromium, and silver, identified during the BGOURI.

Groundwater samples were analyzed for TCL VOCs, TAL metals, and acidity. Table 2-9 summarizes the results for the chemicals that were positively detected in the groundwater samples. Descriptive statistics (i.e., frequency of detections, minimum and maximum concentrations, range of detection limits, and the associated sample numbers) and information for the chemicals of potential concern (COPC) screening for the HHRA are tabulated in Tables 2-10 and 2-11. Different exposure scenarios (i.e., direct exposure and migration) are considered in each table.

Chloroform was the only VOC detected in the six groundwater samples. It was detected once in the sample from 15TW03 at a concentration of 3 µg/L.

TCE, which was detected in groundwater samples from three monitoring wells (15MW1S, 15MW2S, and 15MW3S) during the BGOURI, was not detected in the groundwater samples collected from these same three monitoring wells or the three new temporary monitoring wells during the DGI. Table 2-12 summarizes TCE results from the Phase II RI, BGOURI, and DGI for the three permanent Site 15 wells. The results show that TCE was only detected during the BGOURI. Considering both the soil and groundwater data, it appears that the detections of TCE in the groundwater samples during the BGOURI were anomalies and are not indicative of a site or upgradient source issue. Although proper field sampling and decontamination procedures were used during the BGOURI, and data validation was not able to eliminate the detections, it would appear that the TCE detections were related to laboratory or field sampling issues. This statement is further supported by the fact that low-level concentrations of TCE were also found in several monitoring wells at other sites during the BGOURI that did not historically have TCE detections.

As shown on Table 2-10, 15 inorganics were detected in both total and filtered groundwater samples collected from Site 15 during the DGI. Zinc was detected at total and dissolved concentrations in excess of the background concentrations. The dissolved concentrations of aluminum in two samples were also

above the background level. The total and dissolved concentrations of inorganics were similar for the DGI samples, indicating that proper low-flow sampling techniques were used and that turbidity/total suspended solids (TSS) did not influence analytical results (see Table 2-13).

The inorganics cadmium, chromium, lead, nickel, silver, and zinc were identified as groundwater COPCs during the BGOURI. Cadmium was detected in only one sample (15TW02) during the DGI at a concentration (4.4 µg/L) similar to the maximum concentration (3.4 µg/L) detected during the BGOURI. Chromium, lead, and silver were detected at total concentrations that were one to three orders of magnitude lower during the DGI than the BGOURI. Nickel was not detected in any of the groundwater samples collected during the DGI. The maximum total zinc concentration during the DGI (365 µg/L) was detected in the same well (15MW2S) and at the same magnitude (349 µg/L) as during the BGOURI.

The concentrations of the BGOURI groundwater COPCs detected in permanent monitoring wells 15MW1S, 15MW2S, and 15MW3S during the Phase II RI, BGOURI, and DGI are presented in Table 2-12. A review of the results indicates that the chromium, lead, nickel, and silver concentrations detected during the BGOURI were anomalies because they were not detected during previous or subsequent sampling events. Table 2-13 summarizes relevant water quality data collected during the Phase II RI, BGOURI, and DGI and iron and aluminum results for the same sampling events. This data was evaluated to determine the cause(s) for the anomalies. Turbidity levels measured in the wells were relatively low [less than 10 Nephelometric turbidity units (NTUs)] during the BGOURI, but total dissolved solids (TDS) levels were somewhat high [greater than 150 milligrams per liter (mg/L)] in 15MW1S and 15MW2S. The high TDS levels correlate with the elevated detection limits reported for total aluminum (15MW1S) and total iron (15MW2S) which indicates that something was present in the groundwater samples that interfered with the analysis of them. The sampling technique used during the BGOURI may have contributed to the elevated TDS levels. A submersible pump (Redi-Flo Grundfos) versus peristaltic pump was used to collect samples during the BGOURI. The pump may have agitated fine particles that had accumulated in the well since it was originally developed. These wells were originally developed and sampled in 1994, approximately six years prior to the BGOURI. Therefore, it is possible that there were several factors (build up of fines in well/time between sampling events, sampling technique, and interferences with laboratory equipment) that contributed to the anomalous metals results from the BGOURI.

2.5.2.4 Site 18

An evaluation of the nature and extent of groundwater contamination at Site 18 is provided below. The discussion includes groundwater data collected during the BGOURI in 2000. Groundwater sample locations are shown on Figure 2-6. Table 2-14 presents a summary of positive groundwater analytical results for Site 18. Analytical results for groundwater samples are summarized in Tables 2-15 and 2-16.

No VOCs, SVOCs, pesticides, or PCBs were detected in the groundwater samples collected at Site 18.

Aluminum, beryllium, calcium, iron, magnesium, manganese, potassium, and sodium were detected in one or both of the groundwater samples collected at Site 18. The concentrations of these metals were all below background except beryllium, which was not detected in background samples. The concentration of beryllium was below all direct contact screening criteria and CTDEP pollutant mobility criteria.

2.5.2.5 Site 20

Phase II RI

Overburden

No overburden groundwater samples were collected from Site 20 during the Phase I RI. Three overburden wells were installed and sampled during the Phase II RI; however, no VOCs were detected. Five SVOCs were detected at low concentrations. A common field and laboratory contaminant, bis(2-ethylhexyl)phthalate, was detected in three of six samples at concentrations ranging from 2 µg/L to 3 µg/L. 1,3-DCB (0.6 µg/L), benzo(g,h,i)perylene (1 µg/L), dibenzo(a,h)anthracene (0.8 µg/L), and indeno(1,2,3-cd)pyrene (1 µg/L) were each detected in one of two groundwater samples collected from well 2WCMW1S.

Nineteen metals were detected in unfiltered groundwater samples collected from the overburden wells. Sixteen metals were detected in the corresponding filtered groundwater samples. A majority of the maximum concentrations of metals were associated with groundwater samples collected from well 2WCMW3S, located south of the site along the drainageway into Site 2B. Concentrations of metals in filtered and unfiltered samples were relatively similar (i.e., at the same order of magnitude). Notable concentrations reported for groundwater samples include the maximum concentrations of arsenic (19.9 µg/L), boron (3,810 µg/L), manganese (6,540 µg/L), and sodium (3,580,000 µg/L).

Bedrock

Three groundwater samples were collected (during the Phase I RI and Rounds 1 and 2 of the Phase II RI) from a single Site 20 bedrock well (2WMW4D). Six VOCs, including three ketones and three halogenated aliphatics, were detected at concentrations ranging from 1 µg/L to 12 µg/L. Three SVOCs were detected at concentrations ranging from 2 µg/L to 7 µg/L. Benzoic acid and di-n-octyl phthalate were each detected in one of three samples, and bis(2-ethylhexyl)phthalate was detected in two of three samples.

Thirteen inorganics were detected in unfiltered groundwater samples collected from the bedrock. Seven inorganics were detected in the corresponding filtered groundwater samples. The maximum concentrations of a majority of inorganics in overburden well samples were more than an order of magnitude greater than respective maximum concentrations of inorganics detected in bedrock well samples.

BGOURI

Tables 2-17 and 2-18 summarize frequency of detection information for BGOURI groundwater results from Site 20 and screen the data against direct exposure and migration criteria, respectively. The nature and extent of contamination discussion provided below differentiates between geologic units (overburden or bedrock); however, Tables 2-17 and 2-18 present a combined set of BGOURI groundwater analytical data.

Overburden

TCE and 4-methyl-2-pentanone were the only VOCs detected in the groundwater samples collected from the overburden wells at Site 20. TCE and 4-methyl-2-pentanone were detected in one sample from well 2WCMW2S at concentrations of 5.02 µg/L and 1.29 µg/L, respectively. VOCs were not detected in groundwater samples collected from the overburden aquifer during previous investigations.

PAHs and 4-methylphenol were the only SVOCs detected in groundwater samples collected from the overburden aquifer. PAHs were detected in one groundwater sample from well 2WCMW2S at concentrations ranging from 0.03 µg/L [benzo(k)fluoranthene] to 0.13 µg/L (fluoranthene). 4-Methylphenol was detected in one sample from well 2WCMW3S at a concentration of 9 µg/L. PAHs were also detected at low concentrations in groundwater samples collected during previous investigations.

Sixteen metals were detected in unfiltered overburden groundwater samples, and two metals (calcium and zinc) were detected in filtered overburden groundwater samples. The concentrations of the metals were higher in unfiltered samples than in filtered samples. In general, metals were also detected at similar concentrations (i.e., at the same order of magnitude) in groundwater samples collected during the previous investigations.

Bedrock

TCE, at a concentration of 3.8 J µg/L, was the only VOC detected in the groundwater sample collected from the bedrock aquifer. TCE was also detected at similar concentrations in groundwater samples from the bedrock aquifer during previous investigations.

No SVOCs were detected in the groundwater sample collected from the bedrock aquifer. Benzoic acid, bis(2-ethylhexyl) phthalate, and di-n-octyl phthalate were detected at low concentrations in groundwater from the bedrock aquifer during previous investigations.

Calcium, magnesium, potassium, and sodium were the only inorganics detected in the groundwater sample from the bedrock aquifer. These inorganics were also detected at similar concentrations (i.e., at the same order of magnitude) in groundwater samples collected from the bedrock aquifer during previous investigations.

BGOURI Update/FS

Monitoring wells 2WCMW1S and 2WCMW2S were re-sampled during the DGI and analyzed for total and dissolved TAL inorganics. Wells 2WCMW1S and 2WCMW2S were re-sampled because elevated concentrations of silver were detected during the BGOURI. Other groundwater COCs identified during the BGOURI risk assessment included TCE, benzo(a)pyrene, arsenic, and thallium. These COCs were further evaluated during the preparation of the DGI Work Plan. Factors such as the frequency and magnitude of the detections and the source of the contamination were evaluated, and it was determined that additional investigation of these four COCs was not warranted during the DGI.

Table 2-19 summarizes the analytical results for chemicals that were positively detected in groundwater at Site 20 during the DGI. Tables 2-20 and 21 provide frequency of detection information for the results and screen the data against direct exposure and migration criteria, respectively. The inorganic concentrations detected during the DGI were typically lower than the concentrations detected during the BGOURI. Concentrations of arsenic, chromium, copper, lead, silver, and zinc were significantly lower in well 2WCMW1S. The silver concentration in 2WCMW2S also decreased significantly. Some exceptions were aluminum and zinc, which were detected at higher concentrations in well 2WCMW2S during the DGI.

Table 2-22 summarizes the concentrations of the Site 20 COPCs, as identified in the BGOURI, for all sampling events conducted at the site. This table was developed to show data trends and to help interpret the data. From Table 2-22, it can be seen that silver was detected at Site 20 once at a dissolved concentration of 3.7 µg/L in well 2WCMW2S during two rounds of sampling conducted for the Phase II RI.

Silver was detected at total concentrations of 326 J $\mu\text{g/L}$ and 114 J $\mu\text{g/L}$ in wells 2WCMW1S and 2WCMW2S, respectively, during the BGOURI. Silver was not detected (4.8 U $\mu\text{g/L}$) in either well sampled during the DGI. These results indicate that the silver concentrations detected during the BGOURI in wells 2WCMW1S and 2WCMW2S were anomalies because they were not detected during previous or subsequent sampling events. Similar anomalies in the concentrations of metals were noted in the Site 15 groundwater data collected during the BGOURI. Table 2-23 summarizes relevant water quality data collected during the Phase II RI, BGOURI, and DGI and iron and aluminum results for the same sampling events. These data were evaluated to determine the cause(s) for the anomalies. Turbidity levels measured in the two wells were relatively low (less than 10 NTUs) suggesting that suspended solids were not the cause. Filtered groundwater samples were not collected during the BGOURI, but samples were collected and analyzed for total dissolved solids (TDS) and total suspended solids (TSS). TSS levels in the samples were relatively low (less than 8 mg/L), but TDS levels were very high (greater than 1000 mg/L) in 2WCMW1S. Similar high TDS levels were detected in Site 15 samples, and it was speculated that the high TDS levels may have interfered with the analysis of the groundwater samples. It is also possible that the high iron concentrations (greater than 13,800 J $\mu\text{g/L}$) detected in the two wells may have resulted in iron build up (mineral film/scale) on the well screen. These wells were originally developed and sampled in 1994, approximately 6 years prior to the BGOURI. The sampling technique used during the BGOURI, may have dislodged the mineral film and affected the samples from these wells. A submersible pump (Redi-Flo Grundfos) versus peristaltic pump was used to collect samples during the BGOURI, and the insertion of the pump into the well would have dislodged some of the mineral film. Therefore, it is possible that several factors (iron build up/time between sampling events, sampling technique, and interference from laboratory equipment) contributed to the anomalous silver results from the BGOURI.

2.5.2.4 Summary of Nature and Extent of Contamination

Site 3

Chlorinated VOCs (e.g., cis-1,2-dichloroethene, TCE, and VC) and PAHs were the primary contaminants detected in the groundwater at Site 3. Chlorinated VOCs were detected during all of the investigations, and it is likely that their detections are the result of solvents being released to groundwater via the two septic systems and associated leach fields at Site 7 and migrating downgradient to Site 3. The concentrations of the VOCs detected during the most recent investigation (2002) were less than concentrations detected during previous investigations (1994), indicating that a continuing source of contamination is not present and that natural degradation processes are working. The VOCs were found primarily along the length of Stream 5 (Figure 2-16). The PAHs, which were detected infrequently, were found to be related to suspended solids in samples collected from recently installed and sampled temporary wells and not a site-specific groundwater concern.

Site 7

Investigations at Site 7 found contaminants such as benzene, chlorobenzenes (1,4-DCB, CB, and HCB), phenanthrene, and TCE in the groundwater (Figure 2-17). The contaminants were probably released to the groundwater via the two historical septic systems and associated leach fields.

Site 14

A single well was installed at Site 14, and it was sampled in 1994 and 2000. Naturally occurring metals were the only chemicals consistently detected in the groundwater at this site.

Site 15

Historic investigations at Site 15 identified TCE and inorganics (cadmium, chromium, lead, nickel, silver, and zinc) as the primary groundwater contaminants. SVOCs were also detected infrequently at low concentrations. A DGI was conducted to confirm the historic results. TCE was not detected in the DGI groundwater samples. Chromium, lead, nickel, and silver were either not detected or detected at much lower concentrations during the DGI. The DGI results showed that the previous results were anomalies that may have been caused by the groundwater sampling technique used to collect the samples.

Site 18

No VOCs, SVOCs, pesticides, or PCBs were detected in the groundwater samples collected at Site 18. Aluminum, beryllium, calcium, iron, magnesium, manganese, potassium, and sodium were detected below background except beryllium, which was below all direct contact screening criteria and CTDEP pollutant mobility criteria.

Site 20

The overburden and bedrock groundwater at Site 20 was characterized during three separate investigations. VOCs and SVOCs were detected sporadically at low concentrations in the overburden and bedrock groundwater during the investigations. Naturally occurring metals were detected consistently in the groundwater.

2.6 CURRENT AND POTENTIAL FUTURE LAND AND RESOURCE USES

NSB-NLON is currently an active Navy base and should remain so into the foreseeable future. Reasonable potential future land uses of Sites 3, 7, 14, 15, 18, and 20 include the continued use under their current Naval functions.

Sites 3, 7, and 14 are located within designated ESQD arcs of Site 20; therefore, further development is not planned for this area. Navy regulations prohibit construction of inhabited buildings or structures within these arcs and, although existing buildings operate under a waiver of these regulations, no further construction or residential development is planned for of these sites.

The groundwater aquifers found within the overburden and bedrock at Site 3, 7, 14, 15, 18, and 20 are classified as GB by the State of Connecticut. Based on the GB classification, the groundwater is presumed not suitable for human consumption without treatment. Neither aquifer is currently used as a source of drinking water or for industrial water supply purposes, and there are no current plans to use either aquifer in the future for drinking water or industrial water supply purposes. The overburden groundwater discharges locally to streams that eventually discharge to the Thames River or directly to the Thames River. The overburden aquifer is hydraulically connected to the bedrock aquifer.

If the Navy sold this property in the future, it is possible that the sites could be developed for residential use. Therefore, hypothetical future residential use of the sites was evaluated in the HHRA for the purposes of completeness and to determine whether land use controls are needed.

2.7 SUMMARY OF SITE RISKS

The purpose of a risk assessment is to estimate the probability and magnitude of potential adverse human health and environmental effects from exposure to contaminated media at a site. The results of the risk assessment provide the basis for taking action and identify the contaminants and exposure pathways that need to be addressed by the RA.

The human health risks associated with exposure to groundwater at Sites 3, 7, 14, 15, and 20 were originally evaluated in the Phase II RI (B&RE, 1997) and then further refined in the BGOURI (TtNUS, 2002a) and BGOURI Update/FS (TtNUS, 2004) after additional data were collected and new risk assessment guidance was available. The human health risks associated with the groundwater at Site 18 were evaluated in the BGOURI (2002a). The potential ecological risks associated with Site 3 - NSA groundwater after discharging to a surface water body were evaluated in the BGOURI Update/FS (TtNUS, 2004). The results of these risk assessments, as relevant to Sites 3, 7, 14, 15, 18, and 20 groundwater, are provided below.

2.7.1 Human Health Risk Assessment

The major components of a HHRA include data evaluation, exposure assessment, toxicity assessment, risk characterization, and uncertainty analysis. Data evaluation is a task that uses a variety of information to determine which of the chemicals detected in site media are most likely to present a risk to potential receptors. The end result of the evaluation is a list of COPCs and representative exposure point concentrations for each medium. During the exposure assessment, potential human exposure pathways are identified at the source areas under consideration. Chemical-specific toxicity criteria for the identified COPCs are identified during the toxicity assessment and are used in the quantification of potential human health risks. Risk characterization involves quantifying the risks associated with exposure to the COPCs using algorithms established by EPA and CTDEP. Risks from chemicals are calculated for either carcinogenic or noncarcinogenic effects. The uncertainty analysis identifies limitations in the risk assessment that might affect the final risk results. The final result of the risk assessment is the identification of medium-specific COCs and exposure pathways that need to be addressed by an RA.

For Sites 3, 7, 14, 15, 18, and 20, COPCs for groundwater were identified by comparing maximum detected concentrations of contaminants to EPA Region 9 Preliminary Remediation Goals (PRGs) for tap water, CTDEP Groundwater Protection Criteria (GA/GAA), EPA maximum contaminant levels (MCLs), Connecticut MCLs, CTDEP Remediation Standard Regulations (RSRs) for migration of groundwater to surface water, and CTDEP RSRs for volatilization from groundwater to indoor air (see Tables 2-2, 2-3, 2-7, 2-8, 2-10, 2-11, 2-15, 2-16, 2-17, 2-18, 2-20, and 2-21). If the maximum concentration exceeded any criterion the chemical was retained as a COPC for all exposure routes involving that medium.

Potential receptors for the HHRAs for exposures to groundwater included construction workers and future adult residents, with the exception of the Phase II HHRA for Site 3, which only evaluated potential exposures to groundwater for construction workers. Potential exposure pathways are summarized in Table 2-24. These pathways consider the potential for exposure based on present use, potential future use, and location of the sites. Exposure assumptions for the receptors and toxicity information for the COPCs were presented in the Phase II RI (B&RE, 1997), BGOURI (TtNUS, 2002a), and BGOURI Update/FS (TtNUS, 2004) and are not reiterated in this ROD.

Exposure point concentrations for each of the COPCs were developed for reasonable maximum exposure (RME) and central tendency exposure (CTE) scenarios. For the Phase II and BGOURI HHRAs, the maximum and average concentrations were used for the groundwater exposure point concentrations under the RME and CTE scenarios, respectively. Based on the limited data set in the BGOURI Update/FS, the maximum detected concentration was used as the groundwater exposure point concentration under the RME and CTE scenarios.

Potential human health risks resulting from exposure to COPCs were estimated using algorithms established by EPA and CTDEP. The algorithms are used to calculate risk as a function of chemical concentration, human exposure parameters, and toxicity. Risks attributable to exposure to chemical carcinogens were estimated as the probability of an individual developing cancer over a lifetime [incremental cancer risk (ICR)]. According to EPA, risks less than 1×10^{-6} (or a risk of less than one in one million) are generally considered to be "acceptable," and risks greater than 1×10^{-4} (1 in 10,000) are generally considered to be "unacceptable." According to CTDEP, risks less than 1×10^{-5} (1 in 100,000) for cumulative risk or 1×10^{-6} (1 in 1,000,000) for individual chemicals are generally considered to be "acceptable," while risks greater than 1×10^{-5} for cumulative risk or 1×10^{-6} for individual chemicals are generally considered to be "unacceptable." The hazards associated with the effects of noncarcinogenic chemicals were evaluated by comparing an exposure level or intake to a reference dose. If the ratio of the intake of a chemical to the reference dose [hazard quotient (HQ)] exceeds unity, noncarcinogenic (toxic) effects may occur. A hazard index (HI) was generated by summing the individual HQs for all the COPCs associated with a specific pathway. If the value of the HI exceeds unity, noncarcinogenic health effects associated with that particular chemical mixture may occur, and therefore it is necessary to segregate the HQs by target organ effects or mechanism of action. The HQ should not be construed as a probability in the manner of the ICR, but rather as a numerical indicator of the extent to which a predicted intake exceeds or is less than a reference dose (RfD). The results of the HHRAs for Sites 3, 7, 14, and 20 are discussed below.

2.7.1.1 Site 3

Groundwater COPCs for Site 3 and the screening criteria used to identify them are summarized in Tables 2-2 and 2-3. The distribution of Site 3 groundwater COPCs is shown on Figure 2-16. Maximum detected concentrations of 1,1,2-trichloroethane, TCE, VC, benzo(a)pyrene, dibenzo(a,h)anthracene, indeno(1,2,3-cd)pyrene, alpha-BHC, and arsenic (total and dissolved) exceeded the screening criteria for direct contact with groundwater. The maximum detected concentration of arsenic (total) exceeded the CTDEP criteria for protection of migration of groundwater to surface water.

Tables 2-25 and 2-26 present the risk estimates from the BGOURI Update/FS HHRA for Site 3 under the RME and CTE scenarios, respectively. Only the results from the BGOURI Update/FS HHRA are presented in these tables because these risks were based on the most recent groundwater data and current risk assessment methodology. Although not presented in Tables 2-25 and 2-26, the risk estimates from the Phase II HHRA and BGOURI HHRA are comparable to those presented in the BGOURI Update/FS HHRA. Risk Assessment Guidance for Superfund (RAGS) Part D, Summary of Receptor Risks and Hazards for COPCs, tables for Site 3 are included in Appendix D.

Cumulative ICRs and HIs for exposures to groundwater by construction workers were within the EPA and CTDEP acceptable ranges for both the RME and CTE scenarios. ICRs and HIs exceeded the EPA and CTDEP acceptable ranges for hypothetical adult residents under the RME and CTE scenarios. Carcinogenic PAHs, VC, and arsenic were the major contributors to the unacceptable risks. These risks are subject to several sources of uncertainty as discussed below.

In accordance with U.S. Navy policy, chemicals were eliminated as COPCs on the basis of comparison to background. Manganese was the only chemical detected in Site 3 groundwater samples at concentrations that exceeded the direct contact screening criteria, but was not retained as a COPC because detected concentrations were less than the background concentration of manganese. The maximum detected concentration of 764 µg/L exceeded the screening level (88 µg/L), but was less than the EPA Region 9 PRG of 880 µg/L. Potential exposures to groundwater were evaluated for construction workers (dermal contact) and future adult residents (ingestion and dermal contact). Potential risks from dermal exposures to manganese in water are insignificant (EPA, 2001); consequently, the elimination of manganese as a COPC on the basis of background does not significantly affect the risk estimates for the construction worker since this receptor was only evaluated for dermal exposures to groundwater. Future adult residents were evaluated for ingestion and dermal contact with groundwater; therefore, the estimated risks would be higher for the future adult resident if exposures to manganese were evaluated in the HHRA. If exposures to groundwater by a future adult resident were evaluated in the HHRA, then the resulting HQ for manganese would be 0.9 and the total HI would be 3.2, which exceeds the EPA and CTDEP acceptable level of 1.0.

TCE was detected in monitoring wells 6MW6S and 6MW6D, which are part of the Site 6 monitoring program (see Table 2-4 for results). These monitoring wells are located upgradient of the DRMO, just inside the western boundary of Site 3 (see Figures 2-8 and 2-9 for well locations). The data from these wells were not used in the HHRA for Site 3. TCE was detected in groundwater samples from 6MW6D at a maximum concentration of 9.5 µg/L, which exceeds the EPA Region 9 PRG, federal MCL, Connecticut MCL, and CTDEP RSR. This concentration is also higher than the exposure point concentration used for TCE in the HHRA. Consequently, cancer risks would be higher if the data from monitoring well 6MW6D was used in the HHRA. ICRs for exposures to TCE in groundwater presented in the HHRA were 6×10^{-11} for construction workers and 5×10^{-7} for hypothetical adult residents. If the maximum concentration of TCE at 6MW6D had been used in the HHRA the resulting ICRs for exposures to TCE in groundwater would be 3×10^{-10} for the construction worker and 3×10^{-6} for the hypothetical adult resident.

Carcinogenic PAHs were only detected in one groundwater sample, which was collected from a temporary monitoring well. The turbidity associated with this groundwater sample was elevated, consequently the carcinogenic PAHs detected in the groundwater sample from this well are believed to

be associated with suspended solids in the groundwater sample and are not believed to be dissolved constituents in groundwater. Therefore, the cancer risks presented in the HHRA for exposures to carcinogenic PAHs in groundwater are most likely overestimated and not representative of actual site risks.

As discussed in Section 2.2.1.1, during the RA for OU3, TPH was detected at a concentration of 1,750 mg/kg in a sediment sample collected in Stream 5 at Site 3. During the DGI, stained subsurface soil and petroleum odors were observed in this area, and vapor measurements indicated the presence of petroleum. This information confirms that there is petroleum contamination in the soil. It is likely that TPH concentrations in the soil would be similar to or higher than those found in the sediment sample. TPH concentrations of 1,750 mg/kg or greater would exceed the CTDEP residential RSR of 500 mg/kg, indicating the potential for adverse health effects. This concentration also exceeds the CTDEP GA mobility criterion of 500 mg/kg, indicating that there is a potential for petroleum to migrate from soil to groundwater in this area.

Arsenic was only detected in two of eight groundwater samples collected during the DGI. The concentrations of dissolved arsenic in the groundwater samples are comparable to the background dissolved arsenic concentration. It is likely that the elevated arsenic concentration detected in one unfiltered groundwater sample (2DMW29S) is related to the suspended solids in the groundwater sample. Therefore, the carcinogenic and noncarcinogenic risks presented in the HHRA for exposures to arsenic in groundwater are most likely overestimated and not representative of actual site risks.

1,1,2-Trichloroethene and alpha-BHC were only detected once in groundwater samples collected from temporary wells. The 1,1,2-trichloroethane concentration was below the federal and State MCLs and the CTDEP RSR. No other criteria were available to evaluate the detection of alpha-BHC. The risk associated with alpha-BHC (dermal = 2.1×10^{-6} and ingestion = 1.2×10^{-6}) marginally exceeded CTDEP's 1×10^{-6} risk level for individual chemicals. Based on the low frequencies of detections, the uncertainty associated with data from temporary wells, and the marginal risks associated with the two chemicals, 1,1,2-trichloroethene and alpha-BHC do not appear to be significant COCs for Site 3 groundwater.

The chemicals identified as a concern in Site 3 groundwater during the HHRAs were further evaluated during the uncertainty analysis using additional information such as background levels, nature and extent information (e.g., frequency of detection), field data (water quality), and Applicable or Relevant and Appropriate Requirements (ARARs). The following table summarizes the COCs for Site 3 groundwater identified through the HHRA and uncertainty analysis.

Medium	Method	Scenario	COCs Based on Federal Requirements	COCs Based on CTDEP Requirements
Groundwater	HHRA	Carcinogenic	None	VC
		Non-Carcinogenic	None	None
	Direct Comparison to Criteria	Direct Contact - Residential	TCE (MCL – 2000 and 2002 data) VC (MCL - 2000 data)	TCE (MCL/RSR - 2000 and 2002 data) VC (MCL/RSR - 2000 data)
		Migration from Groundwater to Surface Water	None	Petroleum (TPH)

2.7.1.2 Site 7

The Site 7 groundwater COPCs and the screening criteria used to identify them are summarized in Tables 2-7 and 2-8. Maximum detected concentrations of 1,3-DCB, 1,4-DCB, benzene, chlorobenzene, TCE, bis(2-ethylhexyl)phthalate, HCB, arsenic, barium, chromium, lead, and vanadium exceeded the screening criteria for direct contact with groundwater. Maximum detected concentrations of bis(2-ethylhexyl)phthalate, HCB, phenanthrene, arsenic, lead, silver, and zinc exceeded CTDEP's screening criteria for protection of contaminant migration from groundwater to surface water. The distribution of Site 7 groundwater COPCs is shown on Figure 2-17.

Tables 2-27 and 2-28 present the risk estimates from the BGOURI HHRA for Site 7 under the RME and CTE scenarios, respectively. Only the results from the BGOURI HHRA are presented in these tables because no new data was collected during the DGI for the BGOURI Update and no changes to the HHRA were made during the BGOURI Update. Although not presented in Tables 2-27 and 2-28, the risk estimates from the Phase II HHRA are comparable to those presented in the BGOURI HHRA. RAGS Part D, Summary of Receptor Risks and Hazards for COPCs, tables for Site 7 are included in Appendix D.

Cumulative ICRs and HIs resulting from exposure to groundwater by construction workers were within EPA and CTDEP acceptable ranges for both the RME and CTE scenarios. ICRs and HIs exceeded EPA and CTDEP acceptable ranges for hypothetical adult residents under the RME and CTE scenarios. Benzene, bis(2-ethylhexyl)phthalate, HCB, 1,4-DCB, TCE, arsenic, and chromium were the major contributors to the unacceptable risks. These risks are subject to several sources of uncertainty as discussed below.

HCB, bis(2-ethylhexyl)phthalate, and 1,4-DCB were identified as major risk drivers in groundwater although these chemicals were detected infrequently in groundwater. Bis(2-ethylhexyl)phthalate, a

common laboratory contaminant, is typically associated with plastics (well casings, plastic bottleware, etc). It is unlikely that the detections of bis(2-ethylhexyl)phthalate are associated with a Site 7 source. This information indicates that the elevated risks from exposures to bis(2-ethylhexyl)phthalate are overestimated and that the risks from exposures to HCB and 1,4-DCB in groundwater are limited to a small section of Site 7.

Arsenic and chromium were identified as major risk drivers in groundwater. Arsenic and chromium were detected infrequently in groundwater samples collected during the BGOURI. Detected concentrations of arsenic were less than the Connecticut MCL in all samples and only exceeded the EPA MCL in the sample from temporary monitoring well 7TW09. Detected concentrations of chromium only exceeded the EPA MCL and Connecticut MCL in the groundwater sample from temporary monitoring well 7TW09. The detected concentrations of most other metals were significantly higher in the sample from temporary monitoring well 7TW09 as compared to concentrations in samples from other monitoring wells. The total suspended solids content in the groundwater sample from 7TW09 was two orders of magnitude higher than in any of the groundwater samples from the other wells. It is likely that the elevated arsenic and chromium concentrations detected in the groundwater sample from 7TW09 are related to the suspended solids in the groundwater sample and are not believed to be dissolved constituents in groundwater. Therefore, the cancer risks and HIs presented for arsenic and chromium are most likely overestimated and not representative of actual site risks.

Maximum detected concentrations of bis(2-ethylhexyl)phthalate, HCB, phenanthrene, arsenic, lead, silver, and zinc exceeded CTDEP's screening criteria for protection of contaminant migration from groundwater to surface water. As discussed above, bis(2-ethylhexyl)phthalate was eliminated as a Site 7 concern. Arsenic, lead, and silver were detected at maximum concentrations that exceeded CTDEP's screening criteria for protection of contaminant migration from groundwater to surface water. The maximum concentrations of arsenic, lead, and silver were detected in temporary monitoring well 7TW09. As mentioned above, the total suspended solids content in the groundwater sample from 7TW09 was elevated, and it is likely that the elevated arsenic, lead, and silver concentrations detected in the groundwater sample from 7TW09 are related to the suspended solids in the groundwater sample and are not believed to be dissolved constituents in groundwater. Therefore, it is unlikely that these three metals pose a potential contaminant migration concern. Concentrations of zinc detected in groundwater samples from 7TW09, 7MW1D, and 7MW10S exceeded the CTDEP Surface Water Protection Criteria. The detected concentrations were less than twice the background concentration and CTDEP Surface Water Protection Criteria. As mentioned previously, the inorganics data for 7TW09 are suspect because of high suspended solids in the sample. Total (194 J µg/L) and dissolved (61.9 µg/L) concentrations detected in well 7MW10S also indicate that suspended solids contributed to the elevated zinc concentration detected in this well. The dissolved concentration was below the CTDEP Surface Water Protection Criteria

(123 µg/L). Total (157 µg/L) and dissolved (173 µg/L) zinc concentrations detected in well 7MW1D were generally consistent, indicating no issues with suspended solids, and both exceeded the screening criteria. However, well 7MW1D is located upgradient of the potential source areas at Site 7 and should be reflective of groundwater conditions from upgradient locations (see Figure 3-10). Collectively, this information indicates that zinc is not significant concern for migration from groundwater to surface water at Site 7 and should be eliminated as a COC. Therefore, HCB and phenanthrene are retained as the COCs for migration from groundwater to surface water.

The chemicals identified as a concern in Site 7 groundwater during the HHRA were further evaluated during the uncertainty analysis using additional information such as background levels, nature and extent information (e.g., frequency of detection), field data (water quality), and ARARs. The following table summarizes the COCs for Site 7 groundwater identified through the HHRA and uncertainty analysis.

Medium	Method	Scenario	COCs Based on Federal Requirements	COCs Based on CTDEP Requirements
Groundwater	HHRA	Carcinogenic	HCB	1,4-DCB HCB TCE Benzene
		Non-Carcinogenic	None	None
	Direct Comparison to Criteria	Direct Contact – Residential	1,4-DCB CB HCB TCE (MCL)	1,4-DCB Benzene CB HCB TCE (MCL and/or RSR)
		Migration from Groundwater to Surface Water	None	HCB Phenanthrene

2.7.1.3 Site 14

The contaminants detected in Site 14 groundwater and the screening criteria used to identify COPCs are summarized in Table 2-29. Concentrations of all chemicals in Site 14 groundwater were less than all available screening criteria and basewide background levels, except for iron and manganese, which exceeded their secondary MCLs. It should be noted that secondary MCLs are non-enforceable guidelines regulating contaminants that may cause cosmetic effects (such as skin or tooth discoloration) or aesthetic effects (such as taste, odor, or color) in drinking water. Consequently, no COPCs were retained for Site 14 groundwater, and no adverse health effects are anticipated from exposure to Site 14 groundwater.

2.7.1.4 Site 15

The human health risks associated with Site 15 were originally evaluated in the BGOURI (TtNUS, 2002a) and then further refined in the BGOURI Update/FS (TtNUS, 2004) after additional data was collected. Additional evaluation of the soil collected at Site 15 during the DGI for the BGOURI Update was completed and confirmed that the NFA Source Control ROD for the site soil (1997) was still appropriate.

Groundwater COPCs for Site 15 and the screening criteria used to identify them are summarized in Tables 2-10 and 2-11. The maximum detected concentration of cadmium exceeded the EPA Region 9 PRG for tap water but was less than the EPA MCL, CTDEP RSR, and Connecticut MCL. The maximum detected concentrations of zinc (total and dissolved) and cadmium (dissolved) exceeded the CTDEP criteria for protection of migration of groundwater to surface water.

Tables 2-30 and 2-31 present the risk estimates from the BGOURI Update/FS HHRA for Site 15 under the RME and CTE scenarios, respectively. Only the results from the BGOURI Update/FS HHRA are presented in this table since these risks were based on the most recent data and current risk assessment methodology. Risk Assessment Guidance for Superfund (RAGS) Part D Summary of Receptor Risks and Hazards for COPCs tables for Site 15 are included in Appendix D.

No carcinogenic COPCs were identified in groundwater; therefore, no ICRs were calculated for exposures to groundwater. HIs for exposures to groundwater by construction workers and future adult residents were within the EPA and CTDEP acceptable ranges for both the RME and CTE scenarios. These risks are subject to several sources of uncertainty as discussed below.

Chemicals were eliminated as COPCs on the basis of comparison to background. Manganese was the only chemical detected in Site 15 groundwater samples at concentrations that exceeded the direct contact screening criteria, but was not retained as a COPC on the basis of background. The maximum detected concentration of 702 µg/L exceeded the screening level (88 µg/L), but was less than the EPA Region 9 PRG of 880 µg/L. Potential exposures to groundwater were evaluated for construction workers (dermal contact) and future adult residents (ingestion and dermal contact). Potential risks from dermal exposures to manganese in water are insignificant (EPA, 2001); consequently, the elimination of manganese as a COPC on the basis of background does not significantly affect the risk estimates for the construction worker since this receptor was only evaluated for dermal exposures to groundwater. Future adult residents were evaluated for ingestion and dermal contact with groundwater; therefore, the estimated risks would be higher for the future adult resident if exposures to manganese were evaluated in the HHRA. If exposures to groundwater by a future adult resident were evaluated in the HHRA, then the resulting HQ for manganese would be 0.8 and the total HI would be 1.1, which exceeds the EPA and CTDEP acceptable level of 1.0. However, the HQs for the individual target organs are all less than 1.

The results of the HHRA indicated that cancer risks and hazard indices were within EPA and CTDEP acceptable levels for future adult residents exposed to groundwater. Even though the calculations were not performed, cancer risks and hazard indices for future child residents would also be expected to be within EPA and CTDEP acceptable levels.

The maximum detected concentrations of zinc (total and dissolved) and cadmium (dissolved) exceeded the screening criteria for the migration from groundwater to surface water. Site 15 is not located close to any surface water bodies; therefore, it is unlikely that these exceedances are significant. Concentrations of total cadmium in all DGI groundwater samples were below the screening criteria. Dissolved cadmium was only detected in one groundwater sample and the detected concentration of 6.4 µg/L is essentially equal to the screening criteria of 6 µg/L. Therefore, cadmium is not retained as a COC for the migration of groundwater to surface water. Zinc is also not retained as a COC because of the migration distance to the closest surface water body (Thames River).

Comparison of the Phase II RI and DGI analytical results to the BGOURI results indicate that the BGOURI results were anomalies and were not representative of site conditions. The cause(s) of the BGOURI anomalies may have been the field sampling methodology and/or laboratory issues.

The HHRA, data screening results, and uncertainty analysis showed that there are no groundwater COCs for Site 15. Consequently, no adverse health effects are anticipated from exposure to Site 15 groundwater.

2.7.1.5 Site 18

The Site 18 groundwater COPCs and the screening criteria used to identify them are summarized in Tables 2-15 and 2-16. No direct contact or migration COPCs were identified for groundwater; therefore, no ICRs and HIs were calculated for exposures to groundwater.

Chemicals were eliminated as COPCs on the basis of comparison to background. Manganese in groundwater was the only chemical with a maximum detected concentration that exceeded its direct contact screening criteria but was not retained as a COPC on the basis of background. Exposures to groundwater were not evaluated in the HHRA since no COPCs were identified for groundwater at Site 18, although potential receptors for exposures to groundwater would be construction workers and adult residents. Potential risks from dermal exposures to manganese in water are insignificant (EPA, 2001); consequently, the elimination of manganese as a COC on the basis of background would not affect risk estimates for the construction worker since this receptor would only be evaluated for dermal exposures to groundwater. Potential exposure pathways for future adult residents include ingestion and dermal contact

with groundwater. If exposures to manganese in groundwater by a future adult resident were evaluated in the HHRA, then the resulting HQ for manganese would be 0.4, which is less than the EPA and CTDEP acceptable level of 1.0, indicating that no adverse health effects are anticipated for adult residents exposed to manganese in groundwater at Site 18.

The HHRA, data screening results, and uncertainty analysis showed that there are no groundwater COCs for Site 18 and no adverse health effects are anticipated from exposure to Site 18 groundwater.

2.7.1.6 Site 20

The Site 20 COPCs and the screening criteria used to identify them are summarized in Tables 2-17 and 2-18 and Tables 2-20 and 2-21. Maximum concentrations of TCE, benzo(a)pyrene, antimony, arsenic, nickel, silver, and thallium detected during the BGOURI (Table 2-17) exceeded the screening criteria for direct contact with groundwater. The maximum concentration of arsenic detected during the DGI for the BGOURI Update (Table 2-20) was the only chemical that exceeded the screening criteria for direct contact with groundwater. Maximum concentrations of arsenic, silver, and zinc detected during the BGOURI (Table 2-18) and the maximum concentration of zinc (filtered) detected during the DGI for the BGOURI (Table 2-21) exceeded CTDEP's screening criteria for protection of contaminant migration from groundwater to surface water. The analytical results from the DGI for the Site 20 groundwater COPCs is shown on Figure 2-18.

Tables 2-32 and 2-33 present the risk estimates from the BGOURI HHRA for Site 20 under the RME and CTE scenarios, respectively. Only the results from the BGOURI HHRA are presented in these tables because only a collective data set was available from the BGOURI. The data set from the BGOURI Update/FS only included metals and was not sufficient for updating the baseline HHRA. Although not presented in Tables 2-32 and 2-33, the risk estimates from the Phase II HHRA are comparable to those presented in the BGOURI HHRA. RAGS Part D, Summary of Receptor Risks and Hazards for COPCs, tables for Site 20 are included in Appendix D.

Cumulative ICRs and HIs for exposures to groundwater by construction workers were within EPA and CTDEP acceptable risk ranges for both the RME and CTE scenarios. ICRs and HIs exceeded the EPA acceptable risk range for hypothetical adult residents under the RME scenario but were within the acceptable risk range under the CTE scenario. ICRs exceeded the CTDEP acceptable risk ranges for hypothetical adults under the RME and CTE scenarios, while HIs were within the CTDEP acceptable risk ranges under the RME and CTE scenarios. TCE, benzo(a)pyrene, arsenic, silver, and thallium were the major contributors to the unacceptable risks.

Groundwater sampling results from the DGI were evaluated in a screening risk evaluation by developing risk ratios for each chemical detected at concentrations exceeding the screening criteria. Table 2-34 presents the results of the screening risk evaluation for the DGI groundwater data. The results of the screening evaluation indicate that the ICR for exposure to arsenic in groundwater at Site 20 is within EPA's target risk range, but exceeds the CTDEP acceptable risk level of 10^{-5} for cumulative exposures. The risk estimates presented in the BGOURI HHRA and DGI screening evaluation are subject to several sources of uncertainty as discussed below.

ICRs for TCE, benzo(a)pyrene, and arsenic, and HIs for arsenic, silver, and thallium exceeded EPA and CTDEP acceptable levels in the BGOURI HHRA. TCE was not detected in groundwater samples collected during Phase II RI and was only detected in one sample collected during the BGOURI. The detected concentration of TCE (5.02 µg/L) was essentially equal to the federal MCL (5 µg/L), the Connecticut GA/GAA groundwater criterion (5 µg/L), and the Connecticut MCL (5 µg/L); consequently, TCE is not considered a COC in Site 20 groundwater. Benzo(a)pyrene was not detected in groundwater samples collected during the Phase II RI and was only detected in one groundwater sample collected during the BGOURI. The detected concentration of benzo(a)pyrene (0.05 µg/L) was less than the federal MCL (0.2 µg/L) and the Connecticut GA/GAA groundwater criterion (0.2 µg/L). Therefore, benzo(a)pyrene was not considered as a COC in Site 20 groundwater.

Arsenic was only detected in one BGOURI groundwater well (2WCMW1S) at a concentration that exceeded the federal MCL, Connecticut GA/GAA groundwater criterion, and Connecticut MCL. The concentration of arsenic in this well during the DGI was near background and less than the federal MCL, Connecticut GA/GAA groundwater criterion, and Connecticut MCL. Arsenic is known to be related to dredge spoils in the area, and it is not likely to be related to a Site 20 source. Consequently, arsenic was not retained as a COC for groundwater at Site 20. Silver was not detected in the Phase II RI and DGI groundwater samples, and thallium was not detected in DGI groundwater samples. As discussed above in Section 2.5.2.3, the detected concentrations of silver in Site 20 groundwater samples are believed to be anomalies. Consequently, silver and thallium were not considered groundwater COCs at Site 20. Therefore, no COCs for direct contact exposures to groundwater at Site 20 were identified.

Maximum detected concentrations of arsenic and lead in Phase II groundwater samples; arsenic, silver, and zinc in BGOURI groundwater samples, and zinc in DGI groundwater samples exceeded CTDEP's screening criteria for protection of migration of groundwater to surface water. As discussed in Section 2.5.2, concentrations of inorganics in groundwater have been lower in more recent sampling rounds, most likely because of changes in sampling techniques. Concentrations of lead, arsenic, and silver were less than the screening criteria in the most recent groundwater samples; therefore, lead, arsenic, and silver were not considered COCs from the migration of groundwater to surface water. Zinc, similar to arsenic, is

believed to be related to the dredge spoil, and therefore was not retained as a COC for the migration of groundwater to surface water.

The chemicals identified as a concern in Site 20 groundwater during the HHRAs were further evaluated during the uncertainty analysis using additional information such as background levels, nature and extent information (e.g., frequency of detection), field data (water quality), and ARARs. Based on the results of the HHRA and uncertainty analysis, there are no COCs identified for Site 20 groundwater and no adverse health effects are anticipated from exposure to Site 20 groundwater.

2.7.2 Summary of Ecological Risk Assessment

An ERA for Site 3 groundwater at the NSA was performed for the BGOURI Update/FS. A summary of this ERA is presented in the following subsections. Ecological risks for the remaining portions of Site 3 and Sites 7, 14, and 20 were evaluated during the Phase II RI. Groundwater was not identified as an ecological issue at those sites. No ecological risk assessments were performed at Sites 15 or 18 because there were no ecological issues identified at the sites. Site 15 is located within a paved parking area and Site 18 is a building. Both sites are in well developed portions of NSB-NLON and neither provide habitats suitable for supporting a wildlife population.

2.7.2.1 Introduction

The goal of the ERA was to determine whether adverse ecological impacts are present as a result of exposure to chemicals released to the environment at Site 3 - NSA. The ERA methodology used was the Final Guidelines for Ecological Risk Assessment (EPA, 1998), the Ecological Risk Assessment Guidance for Superfund: Process for Designing and Conducting Ecological Risk Assessments (EPA, 1997), and Navy Policy for Conducting Ecological Risk Assessments (Navy, 1999b). The ERA consisted of Steps 1, 2, and 3a of the ERA process. A summary of the ERA conducted for the groundwater at Site 3 is provided below.

2.7.2.2 Exposure Assessment

A general description of Site 3 is presented in Section 2.5 of this ROD. Site 3 – NSA, located adjacent to Stream 5 in the northern portion of Site 3, is very small and consists primarily of a steep embankment. The embankment slopes to an intermittent stream (Stream 5) separated from Triton Road by a narrow strip of grassed land (approximately 10 to 15 feet wide). The embankment is covered by large rocks, boulders, and small trees. Figure 2-19 presents the conceptual site model. In summary, the primary source of contamination was assumed to originate at the surface. It is likely that the contamination migrated through the soil to groundwater. In addition, contamination that migrated to groundwater could

have discharged to Stream 5. There is also a possibility that contamination could have migrated to Stream 5 sediment as a result of erosion of the embankment. Ecological receptors can be exposed to contaminants in the surface water, sediment, and surface soil by direct exposure, ingestion of media, and ingestion of contaminated food items.

2.7.2.3 Assessment and Measurement Endpoints

For the ERA, the assessment endpoint associated with exposure to groundwater included the protection of aquatic invertebrates from a reduction in growth, survival, and/or reproduction caused by site-related chemicals.

The following measurement endpoint was used to evaluate the assessment endpoint in this ERA:

- Decreases in survival, growth, and/or reproduction of aquatic invertebrates were evaluated by comparing the measured concentrations of chemicals in the groundwater to surface water screening values designed to be protective of these ecological receptors. Groundwater sample concentrations were compared to surface water screening values as a conservative measure to evaluate the potential migration pathway of groundwater discharge to Stream 5.

2.7.2.4 Identification of Chemicals of Potential Concern

Potential risks to aquatic receptors resulting from exposure to chemicals were evaluated by comparing the chemical concentrations in the groundwater to screening levels. Table 2-35 presents the sources of the screening levels. An ecological effects quotient (EEQ) approach was used to characterize the risk to potential ecological receptors. This approach characterizes potential effects by comparing exposure concentrations to effects data. The EEQs for aquatic receptors were calculated as follows:

$$EEQ = \frac{C_{sw}}{SwSV}$$

where:

- EEQ = Ecological effects quotient (unitless)
 C_{sw} = Contaminant concentration in surface water (µg/L or mg/L)
 SwSV = Surface water receptor screening value (µg/L)

Ecological COPCs were selected by the following procedures:

- Chemicals with EEQs greater than 1.0 (using maximum concentrations) were retained as COPCs for further evaluation because they have a potential to cause risk to ecological receptors.
- Contaminants without screening levels were retained as COPCs but were only evaluated qualitatively.

One VOC, five SVOCs, seven total metals, and three filtered metals were retained as COPCs in groundwater for the potential future exposure scenario of migration to surface water in Stream 5 (Table 2-35). Benzo(a)pyrene, aluminum, barium, copper, iron, lead, and manganese were retained as COPCs because their maximum concentrations exceeded associated surface water screening values (SwSVs). All other chemicals were retained as COPCs because no toxicity information was available for comparison.

2.7.2.5 Step 3A – Refinement of Conservative Exposure Assumptions

Step 3a consists of a refinement of the conservative exposure assumptions used to select COPCs to more realistically estimate potential risks to ecological receptors. This refinement is qualitative in nature and discusses items such as habitat, exposure concentrations, and alternate benchmarks. The chemicals discussed in the following paragraphs were retained as COPCs because their maximum detections in groundwater exceeded SwSVs or because SwSVs were not available for comparison.

VC was retained as a COPC because no SwSV was available for comparison to the maximum groundwater concentration. It should be noted, however, that VOCs are typically not detected in surface water samples due to their high degree of volatility. Also, based on SwSVs for the other VOCs, VC is not expected to be detected in groundwater at sufficient concentrations to cause ecological risks to aquatic receptors if discharged to Stream 5. VC was not retained as a COC.

Benzo(a)pyrene was retained as a COPC because the single detected concentration exceeded the conservative SwSV. However, the SwSV seems overly conservative when compared to SwSVs for other PAHs from different sources (e.g., SwSV for acenaphthene is 23 µg/L, SwSV for fluorene is 3.9 µg/L). Additionally, benzo(a)pyrene was detected in only one of five groundwater samples (i.e., the sample from 3TW28). At such a low groundwater concentration, it is unlikely that benzo(a)pyrene would be detected in surface water upon discharge to Stream 5 due to dilution. Benzo(a)pyrene and other PAHs were also detected in the surface soil sample from this location indicating that its presence in groundwater may be attributable to a lack of proper development (turbidity) in this temporary well. Benzo(a)pyrene was not retained as a COC.

Benzo(g,h,i)perylene, benzo(k)fluoranthene, dibenzo(a,h)anthracene, and indeno(1,2,3-cd)pyrene were retained as COPCs because no individual SwSVs were available for comparison. Alternate surface water benchmarks for these PAHs could not be located; therefore, further evaluation of these chemicals was not possible. However, these chemicals were only detected in one of five groundwater samples (i.e., the sample from 3TW28). As with benzo(a)pyrene, these PAHs are unlikely to be detected in surface water upon discharge to Stream 5 due to dilution. These PAHs were also detected in the surface soil sample from this location indicating their presence in groundwater may be attributable to a lack of proper development in this temporary well. For these reasons, benzo(g,h,i)perylene, benzo(k)fluoranthene, dibenzo(a,h)anthracene, and indeno(1,2,3-cd)pyrene were not retained as COCs.

Aluminum, barium, copper, iron, lead, and manganese in total metals samples were retained as COPCs because their maximum detected concentrations in groundwater exceeded corresponding SwSVs. Barium, iron, and manganese were additionally retained as COPCs in filtered metals samples because their maximum filtered groundwater concentrations exceeded associated SwSVs. Vanadium was additionally retained as a COPC because an SwSV was not available for comparison (see Table 2-35).

Aluminum, copper and lead were detected at maximum concentrations in unfiltered groundwater samples that exceeded their respective SwSVs. Vanadium was detected at a maximum concentration that slightly exceeded background. Aluminum, copper, lead, and vanadium were not detected in filtered samples, however, and detections of these metals in unfiltered samples could be attributable to a lack of proper development of the temporary wells. Only concentration levels that occur in filtered samples are considered to be bioavailable to aquatic organisms. For these reasons, these metals are not likely to be present in groundwater at concentrations that would present unacceptable risks to aquatic receptors after migration to surface water. Aluminum, copper, lead, and vanadium were not retained as COCs.

Barium was detected at a maximum concentration of 74.8 µg/L in unfiltered groundwater sample S3GW3TW3001, exceeding the SwSV of 4 µg/L. However, the background concentration of 227 µg/L is nearly three times greater than the maximum groundwater detection, indicating that barium concentrations are naturally occurring and not likely attributable to a contamination source. Barium was also detected in filtered samples at a maximum concentration of 75.6 µg/L, well below the background filtered concentration of 124 µg/L. For these reasons, site-related risks from barium are not considered likely, and barium was not retained as a COC.

Iron was detected at a maximum concentration of 20,000 µg/L in unfiltered groundwater sample S3GW3TW2801, exceeding the SwSV of 1,000 µg/L. However, the maximum concentration is less than the unfiltered background concentration of iron at 28,200 µg/L. Iron was also detected in filtered samples at a maximum concentration of 15,200 µg/L, well below the background filtered concentration of

25,300 µg/L. For these reasons, site-related risks from iron are not considered likely, and iron was not retained as a COC.

Manganese was detected at a maximum concentration of 764 µg/L in groundwater sample S3GW3TW2701, exceeding the SwSV of 120 µg/L. However, the background manganese concentration of 11,700 µg/L is nearly 15 times greater than the maximum detected groundwater concentration. Additionally, manganese was detected in filtered samples at a maximum concentration of 496 µg/L, well below the background filtered concentration of 9,400 µg/L. For these reasons, site-related risks from manganese are not considered likely, and manganese was not retained as a COC.

2.7.2.6 Summary and Conclusions of ERA

Several chemicals detected in groundwater were initially retained as COPCs because their chemical concentrations exceeded screening levels resulting in EEQs greater than 1.0 based on conservative exposure scenarios. These chemicals were then re-evaluated in Step 3a of the ERA to determine which chemicals have the greatest potential for causing risks to ecological receptors, and therefore, should be retained as COCs for further discussion and evaluation. The ecological endpoints evaluated in this ERA were aquatic receptors. In summary, no chemicals were retained as ecological COCs.

2.8 REMEDIAL ACTION OBJECTIVES

Remedial action objectives (RAOs) provide a general description of what the response actions will accomplish. These goals typically serve as the design basis for many of the remedial alternatives discussed in the next section. The RAOs provide the basis for evaluating remedial options for Sites 3 and 7 groundwater and an understanding of how the risks identified in the previous section will be addressed by the response actions. No RAOs were necessary for Sites 14, 15, 18, and 20 because there were no unacceptable risks and therefore no COCs for the sites.

RAOs were developed to address the COCs detected exclusively at Site 3 (VC) and the COCs detected jointly at Sites 3 and 7 (TCE and HCB). Separate RAOs were developed to address the COCs detected exclusively at Site 7 (1,4-DCB, benzene, and CB).

2.8.1 Sites 3 and 7 Groundwater RAOs

A-1. Protect current receptors (construction workers) from incidental exposure to groundwater contaminated with petroleum and chlorinated hydrocarbons at concentrations greater than PRGs (see Table 2-36). The HHRA did not identify excessive risk to construction workers associated with exposure to groundwater.

- A-2. Protect potential future receptors (potable water supply) from regular ingestion of groundwater contaminated with chlorinated hydrocarbons at concentrations greater than PRGs (see Table 2-36).
- A-3. Protect aquatic ecological receptors by preventing the migration of groundwater contaminated with petroleum hydrocarbons at concentrations greater than PRGs to surface water (see Table 2-36).

Contaminants in groundwater at Sites 3 and 7 were not identified as representing a significant risk to current receptors (construction workers: RAO A-1) or ecological receptors in adjacent water bodies (RAO A-3). However, TCE, VC, and HCB are present in the groundwater at concentrations that could represent a risk to potential future receptors through regular consumption of groundwater (RAO A-2). The maximum concentrations of these chemicals detected in recent sample events (2000 and 2002) are 23 µg/L (TCE), 31.3 µg/L (VC), and 3 µg/L (HCB). Connecticut Class GA groundwater quality standards are 5 µg/L, 2 µg/L, and 1 µg/L, respectively.

TPH data for Site 3 NSA groundwater are not available. However, based on expected concentrations of TPH in soil, the petroleum-contaminated soil at the Site 3 NSA could also impact groundwater. The Navy is currently completing plans to address the petroleum-contaminated soil and debris at Site 3 - NSA (OU3) through excavation and offsite disposal. The cleanup plan was documented in an appendix of the ROD (Navy, 2004d). The cleanup is currently anticipated to occur in 2005. Once implemented, the remedy will eliminate the potential impacts from the petroleum in the future.

Groundwater at Sites 3 and 7 is classified as GB by the State of Connecticut and presumed not suitable for human consumption without treatment. Potable water is supplied and used at NSB-NLON. Therefore, risks to current receptors from exposure to groundwater are minimal. Potential risks to future residents associated with the groundwater at these sites would only occur if a water supply well was placed in select areas of the site (e.g., 6MW6D), if the groundwater was extracted and used without treatment, and if sufficient contamination was present in the groundwater at this location that would result in extended exposure to these chemicals. However, no widespread plume or active potential source(s) of the TCE, VC, and HCB were identified at Sites 3 or 7. As a result, on a site-wide average basis, site groundwater is not likely to represent an unacceptable risk to a future resident.

2.8.2 Site 7 Groundwater RAOs

- B-1. Protect current receptors (construction workers) from incidental exposure to groundwater contaminated with organics at concentrations greater than PRGs (see Table 2-37). The HHRA

did not identify excessive risk to the construction worker associated with exposure to groundwater, and therefore PRGs were not selected.

- B-2. Protect potential future receptors (potable water supply) from regular ingestion of groundwater contaminated with benzene and chlorinated hydrocarbons at concentrations greater than PRGs (see Table 2-37).
- B-3. Protect aquatic ecological receptors by preventing the migration of groundwater contaminated with COCs at concentrations greater than PRGs to surface water, as presented in Table 2-37. Potential risks to aquatic ecological receptors were not identified, and therefore PRGs were not selected (see Table 2-37).

Site 7 groundwater was not identified to represent a significant risk to current receptors (construction workers: RAO B-1) or ecological receptors in adjacent water bodies (RAO B-3). However, CB, DCB, benzene, TCE, and HCB are present in the groundwater at concentrations that could represent a risk to potential future receptors through regular consumption of groundwater (RAO B-2).

Groundwater at Site 7 is classified as GB by the State of Connecticut and presumed not suitable for human consumption without treatment. Potable water is supplied and used at NSB-NLON. Therefore, risks to current receptors from exposure to groundwater are minimal. CB and DCB were detected at significant concentrations (greater than PRGs) in only one temporary monitoring well (165 and 90.5 µg/L, respectively). Groundwater PRGs for these compounds are 100 and 75 µg/L, respectively. Benzene was also detected in this well at a concentration of 2 µg/L. The groundwater PRG for benzene is 1 µg/L. Potential risks to future residents associated with this groundwater would only occur if a water supply well was placed in this area, if the groundwater was extracted and used without treatment, and if sufficient contamination was present at this location to result in extended exposure to these chemicals.

The temporary monitoring well was located near a septic tank and associated piping that could be the historic source of this contamination. CB and DCB were also detected in several wells that are hydraulically downgradient of the septic tank and in the area of the leach field associated with the septic tank. The detected concentrations in the downgradient areas were less than 10 µg/L. Benzene was not detected elsewhere at the site.

TCE was detected in several wells at the Site 7, with a maximum concentration of 23 µg/L (7MW9S). HCB was also detected in this monitoring well at a concentration of 3 µg/L. The groundwater PRGs for TCE and HCB are 5 and 1 µg/L, respectively (see Table 2-37) under a future residential scenario. As discussed previously, potential risks to future residents associated with exposure to this groundwater

would only occur if a water supply well was placed in this area, if the groundwater was extracted and used without treatment, and if sufficient contamination was present for extended exposure to these chemicals. However, no distinct plume or active potential source of the TCE was identified at Site 7; therefore, the potential for extended exposure to contaminated groundwater is unlikely. Because TCE was also detected in an adjacent but much larger site (Site 3), the TCE found in Site 7 groundwater, as well as HCB, were addressed with Site 3 groundwater (Section 2.8.1).

2.9 DESCRIPTION OF ALTERNATIVES

Separate FSs were prepared to evaluate remedial alternatives for the groundwater contamination identified jointly at Sites 3 and 7 and the groundwater contamination identified exclusively at Site 7. One FS involved development and evaluation of alternatives that would address the COCs detected exclusively at Site 3 (VC) and the COCs detected jointly at Sites 3 and 7 (TCE and HCB). The other FS involved preparation and evaluation of alternatives that addressed the COCs detected exclusively at Site 7 (1,4-DCB, benzene, and CB). No FSs were prepared for Sites 14, 15, 18, and 20 because there were no unacceptable risks and therefore no COCs for the sites.

2.9.1 Description of Remedial Alternatives

2.9.1.1 Sites 3 and 7 Groundwater

Alternatives were formulated from the technologies and process options that passed the screening process. The two alternatives selected for detailed evaluation in the FS for combined Sites 3 and 7 groundwater included Alternative GW1-1 (No Action) and Alternative GW1-2 (Institutional Controls with Monitoring). Alternative GW1-1 was evaluated for comparison purposes, and the other alternative was evaluated because of site conditions (generally low concentrations of contaminants, groundwater not classified as a suitable potable water source, and the availability and use of a public water supply) and its ability to meet the RAOs. Active remedial alternatives (e.g., pump and treat) were not considered for Sites 3 and 7 groundwater because they are not effective for the site conditions discussed above.

Alternative GW1-1: No Action

Under this alternative, no activities other than mandatory five-year reviews would be conducted at the sites. The No Action Alternative for groundwater is not expected to be fully protective of human health and the environment. In particular, even though site groundwater is classified as GB, indicating that it is not suitable for regular human consumption, it could potentially be reclassified and used in the future as a potable water supply. Based on the concentrations and sporadic distribution of site groundwater contamination, these risks are possible but not very likely. Also, if groundwater is encountered and removed during construction projects, contaminated groundwater could be discharged to adjacent

streams. Based on the concentrations and distribution of groundwater contamination, potential impact to aquatic ecological receptors may not be significant, but potential risks would not be known. This alternative will be retained to serve as a basis for evaluating other alternatives.

• Estimated Time for Design and Construction:	NA
• Estimated Time for Operation:	30 years
• Estimated Capital Cost:	\$0
• Estimated O&M Costs (Present Worth):	\$89,600
• Estimated Total Present Worth:	\$89,600

Alternative GW1-2: Institutional Controls with Monitoring

This alternative was developed to protect human health by placing restrictions on groundwater extraction and use at the sites. Under this alternative, institutional controls would be implemented to prohibit the placement of groundwater extraction wells in or use of groundwater from this area without first testing the groundwater. Also, if groundwater is encountered and removed during construction projects (e.g., trench dewatering), the groundwater would have to be characterized and properly handled, discharged, or disposed.

Base environmental records would note the location and types of groundwater contamination observed at the sites. Future commercial or residential land use would be permitted as long as institutional controls are maintained. In the event of property transfer and with confirmation that contaminated groundwater remains at the sites, a deed restriction would be used to prohibit the use of groundwater.

New and existing monitoring wells would be used to monitor the natural degradation of VOC and SVOC contaminants. Monitoring would continue until contaminant concentrations have decreased below the PRGs and the resulting concentrations are shown to be protective of human health and the environment.

• Estimated Time for Design and Construction:	6 months
• Estimated Time for Operation:	30 years
• Estimated Capital Cost:	\$59,200
• Estimated O&M Costs (Present Worth):	\$260,300
• Estimated Total Present Worth:	\$319,500

2.9.1.2 Site 7 Groundwater

Alternatives were formulated from the technologies and process options that passed the screening process. The three alternatives selected for detailed evaluation in the FS for Site 7 groundwater included

Alternative GW2-1 (No Action), Alternative GW2-2 (Institutional Controls with Monitoring), and Alternative GW2-3 (Extraction and Off-Site Discharge). Alternative GW2-1 was evaluated for comparison purposes, and the other alternatives were evaluated because of site conditions and their ability to meet the RAOs for Site 7 groundwater.

Alternative GW2-1: No Action

Under this alternative, no activities other than mandatory five-year reviews would be conducted at this site. The No Action Alternative for groundwater is not expected to be fully protective of human health and the environment. In particular, even though site groundwater is classified as GB, indicating that it is not suitable for regular human consumption, it could potentially be used in the future as a potable water supply. Also, if groundwater is encountered and removed during construction projects, contaminated groundwater could be discharged to adjacent streams and potentially impact aquatic ecological receptors. However, this alternative will be retained to serve as a basis for evaluating other alternatives.

• Estimated Time for Design and Construction:	NA
• Estimated Time for Operation:	30 years
• Estimated Capital Cost:	\$0
• Estimated O&M Costs (Present Worth):	\$89,600
• Estimated Total Present Worth:	\$89,600

Alternative GW2-2: Institutional Controls with Monitoring

This alternative was developed to protect human health and the environment by placing restrictions on extraction and use of groundwater at this site. Under this alternative, institutional controls would be implemented to prohibit the placement of groundwater extraction wells in or use of groundwater from this area. If groundwater is encountered and removed during construction projects (e.g., trench dewatering), the groundwater would have to be characterized and properly disposed.

Base environmental records would note the location and types of contamination observed at the site. Future commercial or residential land use would be permitted as long as institutional controls are maintained. In the event of property transfer and with confirmation that contaminated groundwater remains at the site, a deed restriction would be used to prohibit the use of groundwater.

New and existing monitoring wells would be used to monitor the natural degradation of VOC and SVOC contaminants. Monitoring would continue until contaminant concentrations have decreased below the PRGs and the resulting concentrations are shown to be protective of human health and the environment.

• Estimated Time for Design and Construction:	6 months
• Estimated Time for Operation:	30 years
• Estimated Capital Cost:	\$59,700
• Estimated O&M Costs (Present Worth):	\$244,100
• Estimated Total Present Worth:	\$303,800

Alternative GW2-3: Extraction and Off-Site Discharge

This alternative was developed to protect human health and the environment by extracting all contaminated groundwater (approximately 1,250,000 gallons) through one groundwater extraction well and discharging the water to the Groton publicly-owned treatment works (POTW) for treatment. Based on the level of contamination found, pre-treatment of the water is not expected. However, if pre-treatment is necessary, filtration and granular activated carbon (GAC) adsorption could be considered. If implemented, the alternative would represent a clean closure for groundwater at the site with no long-term requirements.

Additional temporary and permanent monitoring wells would be installed to better define the extent of groundwater contamination and to monitor groundwater contaminant capture and cleanup. Collected data would be used to characterize groundwater for treatment needs, if any, and discharge requirements.

• Estimated Time including Design and Completion:	1.5 years
• Estimated Capital Cost:	\$1,018,600
• Estimated O&M Costs (Present Worth):	\$105,500
• Estimated Total Present Worth:	\$1,121,000

2.9.2 Common Elements and Distinguishing Features of Each Alternative

2.9.2.1 Sites 3 and 7 Groundwater

Alternatives GW1-1 and GW1-2 are similar in that neither of the alternatives would actively treat the contaminated groundwater. Ultimately, site contaminants would be expected to degrade through natural biological, chemical, and physical processes. For Alternative GW1-1, no action would be taken except mandatory five-year site reviews.

Both Alternatives GW1-1 and GW1-2 allow the contaminated groundwater to remain in place, but Alternative GW1-2 includes institutional controls to restrict extraction and use of groundwater, monitoring at predetermined intervals until contaminant concentrations have decreased to less than PRGs and the resulting concentrations are shown to be protective of human health and the environment, and periodic

site reviews that would be conducted every 5 years. Alternative GW1-2 would address the exposure pathways and risk issues with Sites 3 and 7 groundwater but would not open the sites for unrestricted future use.

2.9.2.2 Site 7 Groundwater

Alternatives GW2-1 and GW2-2 are similar in that neither of the alternatives would actively treat the contaminated groundwater. Ultimately, site contaminants would be expected to degrade through natural biological, chemical, and physical processes. For Alternative GW2-1, no action would be taken except mandatory five-year site reviews.

Alternatives GW2-1 and GW2-2 allow the contaminated groundwater to remain in place, but Alternative GW2-2 includes institutional controls to restrict extraction and use of groundwater, monitoring at predetermined intervals until contaminant concentrations have decreased to less than PRGs and the resulting concentrations are shown to be protective of human health and the environment, and periodic site reviews that would be conducted every 5 years.

Alternatives GW2-2 and GW2-3 are similar in that they both address the exposure pathways. However, Alternative GW2-2 addresses the exposure pathways associated with Site 7 groundwater by controlling construction and development activities, and Alternative GW2-3 addresses the exposure pathways by removing the contaminated groundwater and sending it to a POTW for treatment. Both alternatives address the risk issues with Site 7 groundwater, but Alternative GW2-3 opens the site for unrestricted future use.

Alternative GW2-3 is the only alternative that provides active remediation of Site 7 groundwater. Alternative GW2-2, a passive alternative that allows for natural degradation of site contaminants, includes only periodic inspection with monitoring.

2.9.3 Expected Outcomes of Each Alternative

2.9.3.1 Sites 3 and 7

Under Alternatives GW1-1 (No Action) and GW1-2 (Institutional Controls with Monitoring), Sites 3 and 7 could not be released for unrestricted use. In the event that the sites were released for unrestricted use, Alternative GW1-1 would not be protective of human health for potential future receptors. Institutional controls would be implemented to restrict extraction and use of groundwater at Sites 3 and 7 under Alternative GW1-2 until the contaminants in groundwater naturally degrade to concentrations less than

the selected PRGs and the resulting concentrations are shown to be protective of human health and the environment.

2.9.3.2 Site 7

Under Alternatives GW2-1 (No Action) and GW2-2 (Institutional Controls with Monitoring), Site 7 could not be released for unrestricted use. In the event that the site was released for unrestricted use, Alternative GW2-1 would not be protective of human health for potential future receptors. Institutional controls would be implemented to restrict extraction and use of groundwater at Site 7 under Alternative GW2-2 until the contaminants in groundwater naturally degrade to concentrations less than the selected PRGs and the resulting concentrations are shown to be protective of human health and the environment.

After implementation of Alternative GW2-3 (Extraction and Off-Site Discharge), Site 7 would be released for unrestricted use. Under this alternative, human health and the environment would be protected because the contaminated groundwater would be extracted from the site, treated as necessary, and discharged.

2.10 SUMMARY OF COMPARATIVE ANALYSIS OF ALTERNATIVES

This section of the ROD summarizes the comparative analysis of alternatives presented in the detailed analysis sections of the two FS Reports. The major objective is to evaluate the relative performance of the alternatives with respect to the nine evaluation criteria so that the advantages and disadvantages of each are clearly understood. The first two evaluation criteria, Overall Protection of Human Health and the Environment and Compliance with ARARs are threshold criteria that must be satisfied by any remedial alternative chosen for the site. The primary balancing criteria are then considered to determine which alternative provides the best combination of attributes. The primary balancing criteria are as follows:

- Long-term effectiveness and permanence
- Reduction in toxicity, mobility, or volume through treatment
- Implementability
- Short-term effectiveness
- Cost

The alternatives are evaluated further against the following two modifying criteria:

- Acceptance by the State
- Acceptance by the community

2.10.1 Overall Protection of Human Health and the Environment

2.10.1.1 Sites 3 and 7

Both of the alternatives would be at least moderately protective of human health and the environment under current conditions. The groundwater is currently classified as GB, groundwater concentrations are relatively low and sporadic or the magnitude of PRG exceedances are minor, and the sites are under military control. As a result, the potential for significant impact to human health and the environment is low. In addition, public potable water is available and used in the area, and local groundwater resources are not normally considered for use.

Also, the COCs in Sites 3 and 7 groundwater are organic and are subject to slow natural biological and chemical degradation. Without active cleanup, groundwater concentrations should decrease to less than PRGs, but several years to several decades may be required. Without monitoring, this natural decrease in contaminant concentrations would not be known.

Under Alternative GW1-1, without monitoring or institutional controls, contamination would remain at the site without adequate notification. Groundwater could potentially be used for human consumption in a future residential scenario (RAO A-2), could be extracted and discharged during construction activities (e.g. excavation dewatering), and/or could migrate without degradation to a local stream and impact ecological receptors (RAO A-3). Based on existing characterization, groundwater is not anticipated to represent a significant risk to current receptors (construction workers) through incidental contact (RAO A-1) or to ecological receptors through migration (RAO A-3).

Under Alternative GW1-2, Institutional Controls with Monitoring, potential future risks associated with groundwater would be addressed. These potential future risks would be addressed by restricting a future residential scenario (RAO A-1), providing requirements for groundwater that could be extracted and discharged during construction activities (e.g., excavation dewatering), and monitoring the migration and natural degradation of groundwater contaminants (RAO A-3). Based on existing characterization, groundwater is not anticipated to represent a significant risk to current receptors (construction workers) through incidental contact (RAO A-2) or to ecological receptors through migration (RAO A-3).

2.10.1.2 Site 7

All of the alternatives would at least moderately protect human health and the environment. The groundwater is currently classified as GB, groundwater concentrations are relatively low level and sporadic or the magnitude of PRG exceedances are minor, and the site is under military control. As a result, the potential for significant impact to human health and the environment is low. In addition, public

potable water is available and used in the area and local groundwater sources are not normally considered for use.

Also, the COCs in Site 7 are organic and are subject to slow natural biological and chemical degradation. Without active cleanup, groundwater concentrations should decrease to less than PRGs, but several years to several decades may be required. Without monitoring, this natural decrease in contaminant concentrations would not be known.

Under Alternative GW2-1, without monitoring or institutional controls, contamination would remain at the site without adequate notification. Groundwater could be used for human consumption in a future residential scenario (RAO B-2), could be extracted and discharged during construction activities (e.g., excavation dewatering), and/or could migrate without degradation to a local stream and impact ecological receptors (RAO B-3). Based on existing characterization, groundwater is not anticipated to represent a significant risk to current receptors (construction workers) through incidental contact (RAO B-1) or to ecological receptors through migration (RAO B-3).

Under Alternative GW2-2, Institutional Controls with Monitoring, potential future risks associated with groundwater would be addressed. These potential future risks would be addressed by restricting a future residential scenario (RAO B-1), providing requirements for groundwater that could be extracted and discharged during construction activities (e.g., excavation dewatering), and monitoring the migration and natural degradation of groundwater contaminants (RAO B-3). Based on existing characterization, groundwater is not anticipated to represent a significant risk to current receptors (construction workers) through incidental contact (RAO B-2) or to ecological receptors through migration (RAO B-3).

For Site 7, Alternative GW2-3 would protect human health and the environment by removing contaminated groundwater from the site, pre-treating the extracted water, if necessary, and discharging the water to the POTW for final treatment and discharge. Groundwater monitoring would be completed to monitor groundwater contaminant capture and cleanup. After removal of the contaminated groundwater from the site, there would be no remaining risks associated with Site 7 groundwater.

2.10.2 Compliance with ARARs

Section 121(d) of CERCLA and the NCP, 40 CFR 300.430(f)(1)(ii)(B), require that RAs at CERCLA sites at least attain legally applicable or relevant and appropriate federal and state requirements, standards, criteria, and limitation, unless such ARARs are waived under CERCLA section 121(d)(4).

2.10.2.1 Sites 3 and 7

An assessment of ARARs and To Be Considereds (TBCs) for Alternative GW1-1 is provided in Table 2-38. The No Action Alternative should comply with chemical-specific ARARs as long as groundwater at the site remains classified as GB. If the groundwater is reclassified to GA, then Alternative GW1-1 would not comply with the ARAR. Considering TBCs, the No Action Alternative would not result in unacceptable risks to current receptors from exposure to contaminated groundwater; however, because no restrictions on groundwater use would be implemented under the alternative, future groundwater use for other purposes could result in unacceptable risks to receptors and result in non-compliance with chemical-specific TBCs. Location- and action-specific ARARs are not applicable to Alternative GW1-1.

An assessment of ARARs and TBCs for Alternative GW1-2 is provided in Tables 2-39 and 2-40. This alternative would comply with all chemical-specific ARARs and TBCs. Institutional controls or deed notifications (if the Navy sells the property in the future) would be implemented to prevent use of contaminated groundwater. Even though contaminants in site groundwater currently exceed groundwater quality standards (Class GA), site groundwater is classified as GB. GA groundwater quality should ultimately be obtained through natural degradation. Monitoring would be used to track this decrease until concentrations are below acceptable levels. This alternative would meet chemical-specific TBCs by preventing exposure to contaminated groundwater until concentrations are below acceptable levels that meet human health concerns. This alternative would also comply with all action-specific ARARs. Monitoring would continue until concentrations are below acceptable levels that meet human health concerns. Any waste (soil or groundwater) generated during the installation of monitoring wells or monitoring activities will be properly characterized and disposed. Location-specific ARARs are not applicable to Alternative GW1-2.

2.10.2.2 Site 7

An assessment of ARARs and TBCs for Alternative GW2-1 is provided in Table 2-38. The No Action Alternative should comply with all chemical-specific ARARs as long as site groundwater remains classified as GB. If the groundwater is reclassified to GA, then Alternative GW2-1 would not comply with the ARAR. Considering TBCs, the No Action Alternative would not result in unacceptable risks to current receptors from exposure to contaminated groundwater; however, because no restrictions on groundwater use would be implemented under the alternative, future groundwater use for other purposes could result in unacceptable risks to receptors and result in non-compliance with chemical-specific TBCs. Location- and action-specific ARARs are not applicable to Alternative GW2-1.

An assessment of ARARs and TBCs for Alternative GW2-2 is provided in Tables 2-39 and 2-40. This alternative should comply with all chemical-specific ARARs and TBCs. Institutional controls or deed

restrictions (if the Navy sells the property in the future) would be implemented to prevent use of contaminated groundwater. Even though contaminants in site groundwater currently exceed groundwater quality standards (Class GA), site groundwater is classified as GB. GA groundwater quality should ultimately be obtained through natural degradation. Monitoring would be used to track this decrease until concentrations are below acceptable levels. This alternative would meet chemical-specific TBCs by preventing exposure to contaminated groundwater until concentrations are below acceptable levels that meet human health concerns. This alternative would also comply with all action-specific ARARs. Monitoring would continue until concentrations are below acceptable levels that meet human health concerns. Any waste (soil or groundwater) generated during the installation of monitoring wells or monitoring activities will be properly characterized and disposed. Location-specific ARARs are not applicable to Alternative GW2-2.

An assessment of ARARs and TBCs for Alternative GW2-3 is provided in Tables 2-41 and 2-42. This alternative would comply with all chemical-specific ARARs and TBCs. Site groundwater with contaminant concentrations that currently exceed groundwater quality standards (Class GA) would be removed and there would be no remaining unacceptable risks to human health. Monitoring would be used to track and confirm this cleanup.

Alternative GW2-3 would comply with action-specific ARARs associated with monitoring and the pre-treatment requirements with the Groton POTW. Monitoring would continue until concentrations are below acceptable levels that meet human health concerns. Any waste (soil or groundwater) generated during the installation of monitoring wells or monitoring activities would be properly characterized and disposed. If pre-treatment residues are generated (filter media and GAC), the off-site disposal of this residue would trigger federal and State solid waste regulations and based on characterization, could trigger hazardous waste regulations. During pre-treatment, these residues would be characterized for hazardous waste properties and recycling value and would be managed accordingly. Location-specific ARARs are not applicable to Alternative GW2-3.

2.10.3 Long-Term Effectiveness and Permanence

2.10.3.1 Sites 3 and 7

Currently, there is an estimated 24,700,000 gallons of contaminated groundwater present at Sites 3 and 7. VC was detected at the highest concentration in the recent groundwater sample events (2000 and 2002) at a maximum concentration of 31.5 µg/L. The corresponding PRG for VC is 2 µg/L. TCE (23 µg/L) and HCB (3 µg/L) were also detected in groundwater at the site at concentrations greater than their respective PRGs (5 and 1 µg/L, respectively).

Alternative GW1-1 may not be effective in the long term. Groundwater contaminants could remain at the site for extended periods of time. Groundwater use, handling, and/or discharge would not be restricted. Ultimately, the site contaminants would be expected to degrade through natural biological, chemical, and physical processes. However, the duration and magnitude of contamination would not be monitored, and the residual risks would not be known.

Alternative GW1-2 is expected to be relatively effective in the long term and will ultimately be permanent. The presence of both federal (NSB-NLON institutional controls) and State (groundwater classifications) controls should effectively prevent the use and exposure to contaminated groundwater. Potential migration and degradation of contaminated groundwater would be monitored and the results would be used to identify the need for additional action. Ultimately, it is expected that improvements in groundwater quality would occur, but it would depend on relatively slow natural biological, chemical, and physical processes. The magnitude of residual contamination would be monitored over time, and potential risks associated with the contamination could be quantified.

2.10.3.2 Site 7

At Site 7 alone, there is estimated to be 170,000 gallons of contaminated groundwater. CB was detected in groundwater at a maximum concentration of 165 µg/L. The corresponding PRG for CB is 100 µg/L. DCB (90.5 µg/L) and benzene (2 µg/L) were also detected at the site at concentrations greater than PRGs (75 and 1 µg/L, respectively).

Alternative GW2-1 may not be effective in the long term. Groundwater contaminants could remain at the site for extended periods of time. Groundwater use, handling, and/or discharge would not be restricted. Ultimately, the site contaminants would be expected to degrade through natural biological, chemical, and physical processes. However, the duration and magnitude of contamination would not be monitored, and the residual risks would not be known.

Alternative GW2-2 is expected to be relatively effective in the long term and will ultimately be permanent. The presence of both federal (NSB-NLON institutional controls) and State (groundwater classifications) controls should effectively prevent the use of contaminated groundwater as a potable water supply. Potential migration and degradation of contaminated groundwater would be monitored, and the results would be used to identify the need for additional action. Ultimately, the site contaminants would be expected to degrade through natural biological, chemical, and physical processes. The magnitude of residual contamination would be monitored over time, and potential risks associated with the contamination could be quantified.

It is estimated that 1,250,000 gallons of groundwater need to be extracted to remove the 170,000 gallons of contaminated groundwater. By removing and treating the Site 7 contaminated groundwater, Alternative GW2-3 would be very effective and permanent. Future monitoring or other actions would not be required. In the unlikely event that a continuing source of contaminants is present, then recontamination of the groundwater could occur.

2.10.4 Reduction of Toxicity, Mobility, or Volume through Treatment

2.10.4.1 Sites 3 and 7

Alternatives GW1-1 and GW1-2 do not use active treatment of site contaminants; therefore, this criterion is not applicable.

2.10.4.2 Site 7

Alternatives GW2-1 and GW2-2 do not use active treatment of site contaminants; therefore, this criterion is not applicable.

Alternative GW2-3 uses pre-treatment at the site or treatment at the POTW to remove and ultimately destroy more than 0.36 pound of VOCs. The ultimate fate of the organics would depend on pre-treatment requirements. If pre-treatment is used, the organics would adsorb onto GAC. During off-site regeneration of the GAC, the organics would be thermally oxidized into mineral compounds. If the organics are treated in the POTW, they would be subject to biological degradation, volatilization (and photochemical destruction), and adsorption onto sludge for ultimate disposal in a landfill.

2.10.5 Short-Term Effectiveness

2.10.5.1 Sites 3 and 7

Both groundwater alternatives are expected to be effective in the short term. The groundwater is currently classified as GB, and the contamination is sporadically distributed across Sites 3 and 7. Groundwater is not used for human consumption, and public potable water is available and used.

There would not be any short-term risks to the community, workers, or environment under Alternative GW1-1 because no active RA would be taken. Alternative GW1-2 remedial actions, including well installation and monitoring, along with implementation of institutional controls, would pose no short-term risk as long as proper worker safety precautions were made when handling potentially contaminated soil and groundwater during well installation and monitoring.

Alternative GW1-1 would not achieve the RAOs. Alternative GW1-2 would achieve the RAOs within approximately 6 months, the time required to implement institutional controls and start monitoring. Under both alternatives, final degradation of site groundwater contamination is expected to require years to decades to complete.

2.10.5.2 Site 7

All three groundwater alternatives are expected to be effective in the short term. The groundwater is currently classified as GB at Site 7. Groundwater is not used for human consumption, and public potable water is available and used.

There would not be any short-term risks to the community, workers, or environment under any of the three alternatives. Under Alternatives GW2-2 and GW2-3, no short-term risks would result as long as proper worker safety precautions were taken during implementation of the alternatives.

Alternative GW2-1 would not achieve the RAOs. Alternative GW2-2 would achieve the RAOs within approximately 6 months, the time required to implement institutional controls and start monitoring. Under both alternatives, final degradation of site groundwater contamination is expected to require years to decades to complete. Alternative GW2-3 can be completed within 1.5 years after the start of design activities. RAOs would be achieved at that time.

2.10.6 Implementability

2.10.6.1 Sites 3 and 7

Alternatives GW1-1 and GW1-2 would be easy to implement. All the necessary documents for Alternatives GW1-2 (groundwater monitoring plan, institutional controls, etc.) can be handled internally by the Navy. Vendors and equipment to perform groundwater monitoring are common and readily available.

2.10.6.2 Site 7

Because no active RA is occurring, Alternatives GW2-1 and GW2-2 would be easy to implement. All the necessary documents for Alternatives GW2-2 (groundwater monitoring plan, institutional controls, etc.) can be handled internally by the Navy. Vendors and equipment to perform groundwater monitoring are common and readily available.

Alternative GW2-3 should be readily implementable. Vendors and equipment to perform this work are common and readily available. POTW facility capacity is also adequate.

2.10.7 Cost

The estimated costs for the alternatives are presented below. It should be noted that for the alternatives evaluated, capital costs and annual O&M costs were calculated using present dollars, and do not account for inflation or the future value of money when calculating annual costs.

Alternative	Capital Cost	O&M Cost (Present Worth)	Total Cost (Present Worth)
Sites 3 and 7			
Alternative GW1-1	\$0	\$89,600	\$89,600
Alternative GW1-2	\$59,200	\$260,300	\$319,500
Site 7			
Alternative GW2-1	\$0	\$89,600	\$89,600
Alternative GW2-2	\$59,700	\$244,100	\$303,800
Alternative GW2-3	\$1,018,600	\$105,500	\$1,121,000

2.10.8 State Acceptance

The State of Connecticut has expressed their support with the Selected Remedy (described in Section 2.12). The State's concurrence letter is provided in Appendix B.

2.10.9 Community Acceptance

Based on comments expressed at the Public Meeting on October 5, 2004 and the written comments received during the public comment period, it appears that the community generally agrees with the Selected Remedy presented in the Proposed Plan. Specific responses to issues raised by the community can be found in the Responsiveness Summary in Section 3.0 of this ROD.

2.11 PRINCIPAL THREAT WASTE

The NCP establishes an expectation that treatment will be used to address the principal threats posed by a site wherever practicable [40 CFR 300.430(a)(1)(iii)(A)]. Based on the results of the investigations and studies, the contaminants in the groundwater at Sites 3, 7, 14, 15, 18, and 20 do not constitute principal threat wastes as defined by the NCP.

2.12 SELECTED REMEDY

This section identifies the Selected Remedy and expands on the details provided in Section 2.9 (Description of Alternatives) of the ROD.

2.12.1 Sites 3 and 7

The Selected Remedy for Sites 3 and 7 groundwater, is to combine Alternatives GW1-2 and GW2-2, Institutional Controls with Monitoring. The Selected Remedy meets all of the RAOs by restricting access to and use of contaminated groundwater and monitoring the decay and potential migration of contaminated groundwater at the site. The Selected Remedy consists of three major components: (1) Implement land use controls at the sites, (2) Conduct a comprehensive monitoring program to track the degradation and decay of site contaminants until they reach the remedial goals (RGs) and the resulting concentrations are shown to be protective of human health and the environment, and to verify that groundwater contaminants are not migrating and impacting other resources, and (3) Complete 5-year reviews of the site until the RGs are reached. The RGs for the Selected Remedy are provided in Table 2-43. They were selected from the PRGs provided in Tables 2-36 and 2-37. The components of the remedy are discussed in more detail below.

2.12.1.1 Institutional Controls

The Navy shall implement institutional controls to achieve the land use control performance objectives. Within 90 days of signature of this Interim ROD for Sites 3 and 7 groundwater, the Navy shall prepare and submit to EPA and CTDEP for review and approval a Land Use Control (LUC) Remedial Design that shall contain implementation and maintenance actions, including periodic inspections. The Navy shall be responsible for implementing, inspecting, reporting, and enforcing the institutional controls described in the ROD in accordance with the approved LUC Remedial Design. Should any institutional control component of the selected remedy fail, the Navy would ensure that appropriate actions are taken to reestablish the selected remedy's protectiveness. The Navy may transfer various operational responsibilities for these actions to other parties through contracts, agreements and/or deed restrictions. However, the Navy acknowledges its ultimate liability under CERCLA for remedy integrity, including for the performance of any transferred operational responsibilities.

The groundwater institutional controls are required because there are hazardous substances in the groundwater at concentrations that could result in unacceptable risks if the use of the groundwater was not controlled or restricted. The objectives of the institutional controls for the selected remedy are the following:

- Prevent the withdrawal and/or use of groundwater from Sites 3 and 7 for potable water purposes or other purposes that may result in unacceptable risks to human health and the environment until the RGs identified in this ROD are met.

- Ensure that groundwater extracted from Sites 3 and 7 during groundwater monitoring or construction dewatering activities is handled, stored, and disposed in accordance with applicable State and federal regulatory requirements.
- Maintain the integrity of the proposed groundwater monitoring system for Sites 3 and 7 until the RGs identified in this ROD are met.

Implementation of institutional controls on groundwater use at Sites 3 and 7 would involve identifying the location, magnitude, and type of contamination and documenting it in the NSB-NLON Installation Restoration Site Use Restrictions Instruction document (5090.18B). The latest version of the instruction (February 5, 2003) identifies the areas with soil institutional controls and provides specific instructions to Navy personnel for conducting excavation, ground disruption, and dewatering work at IR program sites at NSB-NLON. Figure 2-22 shows the areas at NSB-NLON with soil land use controls. After this ROD is signed, the instruction will be updated to include drawings that identify the areas with groundwater institutional controls and to provide specific instructions so that contaminated groundwater will not be extracted or used in a manner that would threaten human health or the environment. Figure 2-23 identifies the areas at NSB-NLON that will have groundwater land use controls. The controls on groundwater use will be maintained until the results of the groundwater monitoring program show that the concentrations of hazardous substances in the groundwater are below the RGs that allow for unrestricted use and exposure.

NSB-NLON is currently an active Navy base and should remain so into the foreseeable future. Potential future land uses for Sites 3 and 7 while the Navy owns the property include the continued use of the sites under their current Naval functions (i.e., industrial and recreational). The future land uses are limited because portions of Sites 3 and 7 are located within designated ESQD arcs of Site 20. Navy regulations prohibit construction of inhabited buildings or structures within these arcs and, although existing buildings operate under a waiver of these regulations, no further construction or residential development is planned for these sites. In addition, the groundwater aquifers found within the overburden and bedrock at Sites 3 and 7 are classified as GB by the State of Connecticut. Based on the GB classification, the groundwater is presumed not suitable for human consumption without treatment. Neither aquifer is currently used as a source of drinking water or for industrial water supply purposes, and there are no plans to use either aquifer in the future for either purpose. The institutional controls for groundwater that will be implemented for Sites 3 and 7 will place further restrictions on the extraction and use of the groundwater at these sites until the groundwater RGs are reached. In the event that the Navy would sell or transfer the property in the future, and with confirmation that contaminated groundwater remains at Sites 3 and/or 7, a deed restriction would be needed to prohibit the use of groundwater at the sites. Future commercial or

residential land use would be permitted as long as controls on groundwater extraction and use were maintained.

2.12.1.2 Monitoring

The following subsections provide additional details on the anticipated groundwater monitoring program for Sites 3 and 7 groundwater. A formal groundwater monitoring plan will be developed with input from EPA and CTDEP prior to implementing the monitoring program. It is anticipated that some minor changes to the program details discussed below will occur during the development of the formal groundwater monitoring plan. The groundwater monitoring plan will be developed in conjunction with the LUC Remedial Design and it will be completed within 90 days following execution of the ROD.

Sites 3 and 7

Approximately eight existing monitoring wells and up to four new monitoring wells would be used to monitor the natural degradation of VOC contaminants (TCE and VC). Four of the existing monitoring wells contain VOCs (TCE and VC) at concentrations greater than RGs (Table 2-43). Four other existing monitoring wells contain VOCs (TCE) at concentrations within 50 percent of the RG. Four new monitoring wells would be placed within the general area of the golf course to monitor potential VOC migration from around the valley and in particular, hydraulically downgradient from permanent monitoring wells in which VOC concentrations exceeded RGs.

In addition, HCB, an SVOC, was detected in one well (7MW9S) at a maximum concentration of 3 µg/L. The RG for HCB is 1 µg/L. Groundwater from this well will be analyzed for HCB and will also be monitored for VOCs because of a TCE detection.

A groundwater monitoring plan would be developed and implemented. It is expected that the 13 monitoring wells would be sampled quarterly for the first year, annually for the next 4 years, and then every 5 years thereafter until contaminant concentrations have decreased to less than RGs for three consecutive sampling events and the resulting concentrations are shown to be protective of human health and the environment, or until the remedy is otherwise deemed protective or modified. The RGs will be met at the completion of the RA in the groundwater at each of the monitoring wells included in the monitoring well network. A risk assessment, following the most recent methodology, may need to be completed to show that the resulting concentrations are protective of human health. Groundwater from all 13 monitoring wells would be tested for VOCs, and groundwater from two of the monitoring wells would also be tested for HCB.

These chemicals are subject to natural degradation processes including biological, chemical, and physical processes. The magnitude and extent of this contamination are expected to decrease naturally overtime, and monitoring would be used to track these decreases.

If subsurface activities are conducted and groundwater is to be encountered, construction workers must wear appropriate personnel protective equipment (PPE). If contaminated groundwater is to be removed, it must be tested, handled, and disposed properly, (e.g., at a POTW or off-site treatment facility and not discharged to an adjacent stream without treatment).

Site 7

To monitor the VOC-contaminated groundwater at Site 7, two new wells (one shallow and one deep) near the septic tank (7TW10 location), two new wells (one shallow and one deep) approximately 60 feet west of the septic tank (7TW09 location), and one new well (7MW3D) would be installed approximately 120 feet west of the septic tank and coupled with the existing 7MW3S monitoring well.

A groundwater monitoring plan would be developed and implemented. It is expected that these monitoring wells (one existing and five new) would be sampled quarterly for the first year, annually for the next 4 years, and every 5 years thereafter until contaminant concentrations have decreased to less than RGs for three consecutive sampling events and the resulting concentrations are shown to be protective of human health and the environment, or until the remedy is otherwise deemed protective or modified. The RGs will be met at the completion of the RA in the groundwater at each of the monitoring wells included in the monitoring network. A risk assessment, following the most recent methodology, may need to be completed to show that the resulting concentrations were protective of human health. The groundwater samples would be analyzed for VOCs only.

Groundwater testing would be conducted to monitor the concentrations and migration of contaminated groundwater near the septic tank east of Building 325. CB, DCB, and benzene have been detected at concentrations greater than RGs. These chemicals are subject to natural degradation processes including biological, chemical, and physical processes. The magnitude and extent of this contamination are expected to decrease naturally overtime, and monitoring would be used to track these decreases.

To determine if PAH-contaminated soil has impacted groundwater, one new monitoring well would be placed near the hydraulically downgradient edge of the PAH-contaminated soil. This well would be sampled quarterly for 1 year and the groundwater samples analyzed for PAHs. If PAHs are not detected in the first year, sampling would be discontinued and the well abandoned. If PAHs are detected, the monitoring would continue annually for the next 4 years, and every 5 years thereafter until contaminant concentrations have decreased to less than RGs.

If subsurface activities are conducted and groundwater is to be encountered, construction workers must wear appropriate PPE. If contaminated groundwater is to be removed, it must be handled and disposed properly (e.g., in a POTW or off-site treatment facility and not discharged to an adjacent stream).

2.12.1.3 Five-Year Reviews

Five-year reviews will be conducted for Sites 3 and 7 groundwater as required under CERCLA until the monitoring program shows that the RGs have been reached and the resulting concentrations are shown to be protective of human health and the environment. The goal of conducting the site reviews is to verify that no changes have occurred that would impact the effectiveness of the Selected Remedy.

2.12.2 Sites 14, 15, 18, and 20

The Navy recommends NFA for Sites 14, 15, 18, and 20 groundwater. Available information indicates that the groundwater at these sites do not pose any unacceptable risks to human health or the environment.

2.13 STATUTORY DETERMINATIONS

Under CERCLA Section 121 and the NCP, the lead agency (i.e., Navy) must select remedies that are protective of human health and the environment, comply with ARARs (unless a statutory waiver is justified), are cost effective, and utilize permanent solutions and alternative treatment technologies or resource recovery technologies to the maximum extent practical. In addition, CERCLA includes a preference for remedies that employ treatment that permanently and significantly reduces the volume, toxicity, or mobility of contamination as a principal element and a bias against off-site disposal of untreated wastes.

The following sections discuss how the Selected Remedy for Sites 3 and 7 groundwater meet these statutory requirements. Because NFA was selected for the groundwater at Sites 14, 15, 18, and 20, an evaluation of these statutory requirements is not necessary.

2.13.1 Protection of Human Health and the Environment

The Selected Interim Remedy for the groundwater at Sites 3 and 7 (Institutional Controls with Monitoring, Alternatives GW1-2 and GW2-2) would address potential future risks and provide adequate protection until a final ROD is signed for OU9. The potential future risks would be addressed by restricting a future residential scenario (RAOs A-1 and B-1), providing requirements for groundwater that could be extracted and discharged during construction activities (e.g., excavation dewatering), and monitoring the migration

and natural degradation of groundwater contaminants (RAOs A-3 and B-3). Based on existing characterization, groundwater is not anticipated to represent a significant risk to current receptors (construction workers) through incidental contact (RAOs A-2 and B-2) or to ecological receptors through migration (RAOs A-3 and B-3).

2.13.2 Compliance with ARARs

An assessment of ARARs and TBCs for the Selected Interim Remedy is provided in Tables 2-39 and 2-40. The remedy should comply with all chemical-specific ARARs and TBCs. Chemical-specific ARARs include the RSRs; these Connecticut regulations provide specific numerical cleanup criteria for contaminants in groundwater. Requirements are based on groundwater in the area being classified by the State as GB. Institutional controls or deed restrictions (if the Navy sells the property in the future) would be implemented to prevent contact with and use of contaminated groundwater. Even though contaminants in site groundwater currently exceed groundwater quality standards (Class GA), site groundwater is classified as GB. GA groundwater quality should ultimately be obtained through natural degradation. Monitoring would be used to track this decrease until concentrations are below acceptable levels. The remedy would meet chemical-specific TBCs by preventing exposure to contaminated groundwater until concentrations are below acceptable levels that meet human health concerns.

The Selected Interim Remedy would also comply with all action-specific ARARs. Monitoring would continue until concentrations are below acceptable levels that meet human health concerns. Any waste (soil or groundwater) generated during the installation of monitoring wells or monitoring activities will be properly characterized and disposed. Location-specific ARARs are not applicable to the Selected Remedy.

2.13.3 Cost Effectiveness

The Selected Remedy would be the most cost-effective alternative. The lower cost No Action alternatives (GW1-1 and 2-1) would not satisfy the threshold criteria or RAOs, and Extraction and Off-Site Discharge (Alternative GW2-3) would cost over \$1 million and only address Site 7 groundwater contaminants.

The cost for the Selected Remedy is estimated to be the sum of the costs for Alternatives GW1-2 (\$319,500) and GW2-2 (\$303,800), or \$623,300. Different wells will need to be drilled and monitored for the two alternatives; therefore the total costs were added. Although some economy may be realized when combining the alternatives, any savings are expected to be within the accuracy range of an FS level cost estimate (e. g., -30 to +50 percent); therefore, no attempt was made to further refine this cost. The present worth cost analysis for the Selected Remedy is presented in Appendix E.

- Estimated Time for Design and Construction: 6 months
- Estimated Time for Operation: 30 years
- Estimated Capital Cost: \$118,900
- Estimated Operations and Maintenance Costs (Present Worth): \$504,400
- Estimated Total Present Worth: \$623,300

2.13.4 Utilization of Permanent Solutions and Alternative Treatment

The Navy, with EPA and State concurrence, has determined that the Selected Remedy represents the maximum extent to which permanent solutions and treatment technologies can be utilized in a practical manner for the groundwater at Sites 3 and 7 until a final remedy is selected for all of OU9. Of those alternatives that are protective of human health and the environment and comply with ARARs, the Navy has determined that the Selected Remedy provides the best balance of trade-offs in terms of the five balancing criteria.

The Navy also considered the statutory preference for treatment as a principal element, the bias against off-site treatment and disposal, and EPA, State, and community acceptance. In-situ and above-ground treatment technologies for groundwater were screened in the technology screening section of the FS, but based on concerns about effectiveness because of relatively low contaminant concentrations and the sporadic distribution of contamination, coupled with anticipated high costs, these technologies were not retained for development of alternatives.

2.13.5 Preference for Treatment as a Principal Element

The Selected Remedy does not satisfy the statutory preference for treatment as a principal element. The reasons why treatment of Sites 3 and 7 groundwater is not practical were discussed in Section 2.13.4.

2.13.6 Five-Year Review Requirements

Because the Selected Remedy will result in hazardous substances, pollutants, or contaminants remaining on site above levels that allow for unlimited use and unrestricted exposure, a statutory review will be conducted within 5 years after initiation of the RA for Sites 3 and 7 groundwater, every 5 years until RGs are met, to ensure that the remedy is, or will be, protective of human health and the environment.

2.14 DOCUMENTATION OF SIGNIFICANT CHANGES

The Proposed Plan for Sites 3, 7, 14, 15, 18, and 20 groundwater at NSB-NLON, Groton, Connecticut was released for public comment on September 24, 2004. The Proposed Plan identified Institutional

Controls with Monitoring (Alternatives GW1-2 and GW2-2) as the Selected Remedy for Sites 3 and 7 groundwater. NFA was recommended for Sites 14, 15, 18, and 20 groundwater in the Proposed Plan. Available information indicates that the groundwater at Sites 14, 15, 18 and 20 do not pose any significant risks to human health or the environment.

The Navy reviewed all written and verbal comments submitted during the public comment period. It was determined that no significant changes to these decisions, as originally identified in the Proposed Plan, were necessary or appropriate.

TABLE 2-1

**SUMMARY OF POSITIVE GROUNDWATER ANALYTICAL RESULTS FOR SITE 3
SITES 3, 7, 14, 15, 18, AND 20 GROUNDWATER RECORD OF DECISION
NSB-NLON, GROTON, CONNECTICUT
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location	2DMW23D	2DMW23D	2DMW29S	2DMW29S	2DMW30S	2DMW30S
nsample	S3GW2DMW23D02	S3GW2DMW23D02-F	S3GW2DMW29S04	S3GW2DMW29S04-F	S3GW2DMW30S04	S3GW2DMW30S04-F
sample	S3GW2DMW23D02	S3GW2DMW23D02-F	S3GW2DMW29S04	S3GW2DMW29S04-F	S3GW2DMW30S04	S3GW2DMW30S04-F
sample_date	10/16/2002	10/16/2002	10/15/2002	10/15/2002	10/15/2002	10/15/2002
Volatile Organics (ug/L)						
1,1,2-TRICHLOROETHANE	1 U		1 U		1 U	
CARBON DISULFIDE	0.2 J		1 U		1 U	
CHLOROFORM	0.9 J		1 U		1 U	
CIS-1,2-DICHLOROETHENE	1 U		3		0.7 J	
TOLUENE	1 U		1 U		1 U	
TOTAL 1,2-DICHLOROETHENE	1 U		3		0.7 J	
TRANS-1,2-DICHLOROETHENE	1 U		1 U		1 U	
TRICHLOROETHENE	1 U		1 U		0.5 J	
VINYL CHLORIDE	1 U		0.3 J		1 U	
Semivolatile Organics (ug/L)						
ACENAPHTHENE	0.2 U		0.2 U		0.2 U	
BENZO(A)PYRENE	0.2 U		0.2 U		0.2 U	
BENZO(G,H,I)PERYLENE	0.2 U		0.2 U		0.2 U	
BENZO(K)FLUORANTHENE	0.2 U		0.2 U		0.2 U	
DIBENZO(A,H)ANTHRACENE	0.2 U		0.2 U		0.2 U	
FLUORENE	0.2 U		0.2 UJ		0.2 U	
INDENO(1,2,3-CD)PYRENE	0.2 U		0.2 U		0.2 U	
Pesticides/PCBs (ug/L)						
ALPHA-BHC						
BETA-BHC						

TABLE 2-1

SUMMARY OF POSITIVE GROUNDWATER ANALYTICAL RESULTS FOR SITE 3
SITES 3, 7, 14, 15, 18, AND 20 GROUNDWATER RECORD OF DECISION
NSB-NLON, GROTON, CONNECTICUT
PAGE 2 OF 6

location	2DMW23D	2DMW23D	2DMW29S	2DMW29S	2DMW30S	2DMW30S
nsample	S3GW2DMW23D02	S3GW2DMW23D02-F	S3GW2DMW29S04	S3GW2DMW29S04-F	S3GW2DMW30S04	S3GW2DMW30S04-F
sample	S3GW2DMW23D02	S3GW2DMW23D02-F	S3GW2DMW29S04	S3GW2DMW29S04-F	S3GW2DMW30S04	S3GW2DMW30S04-F
sample_date	10/16/2002	10/16/2002	10/15/2002	10/15/2002	10/15/2002	10/15/2002
Inorganics (ug/L)						
ALUMINUM						
ARSENIC	1.2 U		25.4		2.0 J	
BARIIUM						
CALCIUM						
CHROMIUM						
COPPER						
IRON						
LEAD						
MAGNESIUM						
MANGANESE						
POTASSIUM						
SODIUM						
VANADIUM						
Filtered Inorganics (ug/L)						
ARSENIC		1.2 U		3.5		2.0 J
BARIIUM						
CALCIUM						
IRON						
MAGNESIUM						
MANGANESE						
POTASSIUM						
SODIUM						

TABLE 2-1

SUMMARY OF POSITIVE GROUNDWATER ANALYTICAL RESULTS FOR SITE 3
SITES 3, 7, 14, 15, 18, AND 20 GROUNDWATER RECORD OF DECISION
NSB-NLON, GROTON, CONNECTICUT
PAGE 3 OF 6

location	3MW14S	3MW14S	3TW27	3TW27	3TW28	3TW28	3TW28
nsample	S3GW3MW14S02	S3GW3MW14S02-F	S3GW3TW2701	S3GW3TW2701-F	S3GW3TW2801	S3GW3TW2801-D	S3GW3TW2801-F
sample	S3GW3MW14S02	S3GW3MW14S02-F	S3GW3TW2701	S3GW3TW2701-F	S3GW3TW2801	FD10250201	S3GW3TW2801-F
sample_date	10/15/2002	10/15/2002	10/25/2002	10/25/2002	10/25/2002	10/25/2002	10/25/2002
Volatile Organics (ug/L)							
1,1,2-TRICHLOROETHANE	1 U		2 J		1 U	1 U	
CARBON DISULFIDE	1 U		1 U		1 U	1 U	
CHLOROFORM	0.4 J		1 U		1 U	1 U	
CIS-1,2-DICHLOROETHENE	1 U		1 J		2 J	3 J	
TOLUENE	1 U		0.3 J		0.3 J	0.2 J	
TOTAL 1,2-DICHLOROETHENE	1 U						
TRANS-1,2-DICHLOROETHENE	1 U		1 U		0.2 J	0.2 J	
TRICHLOROETHENE	1 U		1 J		1 J	2	
VINYL CHLORIDE	1 U		2 J		0.3 J	0.4 J	
Semivolatile Organics (ug/L)							
ACENAPHTHENE	0.2 U		0.11 J		0.13 J	0.13 J	
BENZO(A)PYRENE	0.2 U		0.2 U		0.13 J	0.2 U	
BENZO(G,H,I)PERYLENE	0.2 U		0.2 U		0.28	0.2 U	
BENZO(K)FLUORANTHENE	0.2 U		0.2 U		0.08 J	0.2 U	
DIBENZO(A,H)ANTHRACENE	0.2 U		0.2 U		0.3	0.2 U	
FLUORENE	0.2 U		0.24 J		0.36 J	0.2 U	
INDENO(1,2,3-CD)PYRENE	0.2 U		0.2 U		0.35	0.2 U	
Pesticides/PCBs (ug/L)							
ALPHA-BHC			0.011 U		0.028	0.025	
BETA-BHC			0.011 U		0.015 J	0.017	

TABLE 2-1

SUMMARY OF POSITIVE GROUNDWATER ANALYTICAL RESULTS FOR SITE 3
SITES 3, 7, 14, 15, 18, AND 20 GROUNDWATER RECORD OF DECISION
NSB-NLON, GROTON, CONNECTICUT
PAGE 4 OF 6

location	3MW14S	3MW14S	3TW27	3TW27	3TW28	3TW28	3TW28
nsample	S3GW3MW14S02	S3GW3MW14S02-F	S3GW3TW2701	S3GW3TW2701-F	S3GW3TW2801	S3GW3TW2801-D	S3GW3TW2801-F
sample	S3GW3MW14S02	S3GW3MW14S02-F	S3GW3TW2701	S3GW3TW2701-F	S3GW3TW2801	FD10250201	S3GW3TW2801-F
sample_date	10/15/2002	10/15/2002	10/25/2002	10/25/2002	10/25/2002	10/25/2002	10/25/2002
Inorganics (ug/L)							
ALUMINUM			6780 J		4140 J	732 J	
ARSENIC	1.2 U		2.0 U		2.0 U	2.0 U	
BARIUM			47.4		40.6	30.0	
CALCIUM			13300		16000	16900	
CHROMIUM			8.4		5.8	2.0 U	
COPPER			4.3		14.2	8.0	
IRON			18800		20000	18000	
LEAD			8.4		7.1	2.2	
MAGNESIUM			4410		5500	5230	
MANGANESE			764		438	449	
POTASSIUM			4040		4400	4540	
SODIUM			57800		52400	57300	
VANADIUM			12.1		12.1	4.5 U	
Filtered Inorganics (ug/L)							
ARSENIC		1.2 U		2.0 U			2.0 U
BARIUM				23.1			25.9
CALCIUM				13800			16600
IRON				12000			14800
MAGNESIUM				3730			5000
MANGANESE				496			395
POTASSIUM				3650			4740
SODIUM				59900			55600

TABLE 2-1

**SUMMARY OF POSITIVE GROUNDWATER ANALYTICAL RESULTS FOR SITE 3
SITES 3, 7, 14, 15, 18, AND 20 GROUNDWATER RECORD OF DECISION
NSB-NLON, GROTON, CONNECTICUT
PAGE 5 OF 6**

location	3TW28	3TW30	3TW30
nsample	S3GW3TW2801-F-D	S3GW3TW3001	S3GW3TW3001-F
sample	FD10250201-F	S3GW3TW3001	S3GW3TW3001-F
sample_date	10/25/2002	10/25/2002	10/25/2002
Volatile Organics (ug/L)			
1,1,2-TRICHLOROETHANE		1 U	
CARBON DISULFIDE		1 U	
CHLOROFORM		1 U	
CIS-1,2-DICHLOROETHENE		1 U	
TOLUENE		1 U	
TOTAL 1,2-DICHLOROETHENE			
TRANS-1,2-DICHLOROETHENE		1 U	
TRICHLOROETHENE		1 U	
VINYL CHLORIDE		1 U	
Semivolatile Organics (ug/L)			
ACENAPHTHENE		0.2 U	
BENZO(A)PYRENE		0.2 U	
BENZO(G,H,I)PERYLENE		0.2 UJ	
BENZO(K)FLUORANTHENE		0.2 UJ	
DIBENZO(A,H)ANTHRACENE		0.2 UJ	
FLUORENE		0.2 U	
INDENO(1,2,3-CD)PYRENE		0.2 UJ	
Pesticides/PCBs (ug/L)			
ALPHA-BHC		0.010 U	
BETA-BHC		0.011 R	

TABLE 2-1

**SUMMARY OF POSITIVE GROUNDWATER ANALYTICAL RESULTS FOR SITE 3
SITES 3, 7, 14, 15, 18, AND 20 GROUNDWATER RECORD OF DECISION
NSB-NLON, GROTON, CONNECTICUT
PAGE 6 OF 6**

location	3TW28	3TW30	3TW30
nsample	S3GW3TW2801-F-D	S3GW3TW3001	S3GW3TW3001-F
sample	FD10250201-F	S3GW3TW3001	S3GW3TW3001-F
sample_date	10/25/2002	10/25/2002	10/25/2002
Inorganics (ug/L)			
ALUMINUM		25.4 U	
ARSENIC		2.0 U	
BARIUM		74.8	
CALCIUM		19100	
CHROMIUM		0.55 U	
COPPER		3.4 U	
IRON		14.6 U	
LEAD		1.3 U	
MAGNESIUM		5770	
MANGANESE		56.7	
POTASSIUM		3650	
SODIUM		68800	
VANADIUM		4.5 U	
Filtered Inorganics (ug/L)			
ARSENIC	2.0 U		2.0 U
BARIUM	27.1		75.6
CALCIUM	17500		19100
IRON	15200		14.1 U
MAGNESIUM	5240		5810
MANGANESE	412		58.6
POTASSIUM	4870		3950
SODIUM	57500		69400

From Basewide Groundwater Operable Unit Remedial Investigation Update/Feasibility Study Report (TtNUS, 2004).

TABLE 2-2

OCCURRENCE, DISTRIBUTION, AND SELECTION OF COPCS IN GROUNDWATER AT SITE 3
DIRECT CONTACT EXPOSURE SCENARIOS
SITES 3, 7, 14, 15, 18, 20 GROUNDWATER RECORD OF DECISION
NSB-NLON, GROTON, CONNECTICUT
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Scenario Timeframe: Future
Medium: Groundwater
Exposure Medium: Groundwater
Exposure Point: Site 3

CAS Number	Chemical	Minimum Concentration ⁽¹⁾	Minimum Qualifier	Maximum Concentration ⁽¹⁾	Maximum Qualifier	Units	Location of Maximum Concentration	Detection Frequency	Range of Nondetects ⁽²⁾	Concentration Used for Screening ⁽³⁾	Background Value ⁽⁴⁾	Risk-Based COPC Screening Level ⁽⁵⁾	Potential ARAR/TBC Value	Potential ARAR/TBC Source	COPC Flag ⁽⁶⁾	Rationale for Contaminant Deletion or Selection
Volatile Organic Compounds																
79-00-5	1,1,2-Trichloroethane	2	J	2	J	UG/L	S3GW3TW2701	1/8	1	2	N/A	0.2 C	200 5 5	CTDEP RSR FED-MCL CTDEP-MCL	YES	ASL
75-15-0	Carbon Disulfide	0.2	J	0.2	J	UG/L	S3GW2DMW23D02	1/8	1	0.2	N/A	100 N	700 N/A N/A	CTDEP RSR FED-MCL CTDEP-MCL	NO	BSL
67-66-3	Chloroform	0.4	J	0.9	J	UG/L	S3GW2DMW23D02	2/8	1	0.9	N/A	6.2 C	6 80 100	CTDEP RSR FED-MCL CTDEP-MCL	NO	BSL
156-59-2	cis-1,2-Dichloroethene	0.7	J	3		UG/L	S3GW2DMW29S04/ S3GW3TW2801-D	4/8	1	3	N/A	6.1 N	70 70 70	CTDEP RSR FED-MCL CTDEP-MCL	NO	BSL
108-88-3	Toluene	0.2	J	0.3	J	UG/L	S3GW3TW2701/ S3GW3TW2801	2/8	1	0.3	N/A	72 N	1000 1000 1000	CTDEP RSR FED-MCL CTDEP-MCL	NO	BSL
540-59-0	Total 1,2-Dichloroethene	0.7	J	3		UG/L	S3GW2DMW29S04	2/5	1	3	N/A	N/A	N/A N/A N/A	CTDEP RSR FED-MCL CTDEP-MCL	NO	NTX
156-60-5	trans-1,2-Dichloroethene	0.2	J	0.2	J	UG/L	S3GW3TW2801/ S3GW3TW2801-D	1/8	1	0.2	N/A	12 N	100 100 100	CTDEP RSR FED-MCL CTDEP-MCL	NO	BSL
79-01-6	Trichloroethene	0.5	J	2		UG/L	S3GW3TW2801-D	3/8	1	2	N/A	0.028 C	5 5 5	CTDEP RSR FED-MCL CTDEP-MCL	YES	ASL
75-01-4	Vinyl Chloride	0.3	J	2	J	UG/L	S3GW3TW2701	3/8	1	2	N/A	0.02 C	2 2 2	CTDEP RSR FED-MCL CTDEP-MCL	YES	ASL
Semivolatile Organic Compounds																
83-32-9	Acenaphthene	0.11	J	0.13	J	UG/L	S3GW3TW2801/ S3GW3TW2801-D	2/8	0.2	0.13	N/A	37 N	420 N/A N/A	CTDEP RSR FED-MCL CTDEP-MCL	NO	BSL
50-32-8	Benzo(a)pyrene	0.13	J	0.13	J	UG/L	S3GW3TW2801	1/8	0.2	0.13	N/A	0.0092 C	0.2 0.2 N/A	CTDEP RSR FED-MCL CTDEP-MCL	YES	ASL
191-24-2	Benzo(g,h,i)perylene	0.28		0.28		UG/L	S3GW3TW2801	1/8	0.2	0.28	N/A	N/A	210 N/A N/A	CTDEP RSR FED-MCL CTDEP-MCL	NO	BSL
207-08-9	Benzo(k)fluoranthene	0.08	J	0.08	J	UG/L	S3GW3TW2801	1/8	0.2	0.08	N/A	0.92 C	0.5 N/A N/A	CTDEP RSR FED-MCL CTDEP-MCL	NO	BSL
53-70-3	Dibenzo(a,h)anthracene	0.3		0.3		UG/L	S3GW3TW2801	1/8	0.2	0.3	N/A	0.0092 C	0.5 N/A N/A	CTDEP RSR FED-MCL CTDEP-MCL	YES	ASL
86-73-7	Fluorene	0.24	J	0.36	J	UG/L	S3GW3TW2801	2/8	0.2	0.36	N/A	24 N	280 N/A N/A	CTDEP RSR FED-MCL CTDEP-MCL	NO	BSL
193-39-5	Indeno(1,2,3-cd)pyrene	0.35		0.35		UG/L	S3GW3TW2801	1/8	0.2	0.35	N/A	0.092 C	0.5 N/A N/A	CTDEP RSR FED-MCL CTDEP-MCL	YES	ASL
Pesticides/PCBs																
319-84-6	alpha-BHC	0.025		0.028		UG/L	S3GW3TW2801	1/3	0.01 - 0.011	0.028	N/A	0.011 C	N/A N/A N/A	CTDEP RSR FED-MCL CTDEP-MCL	YES	ASL
319-85-7	beta-BHC	0.015	J	0.017		UG/L	S3GW3TW2801-D	1/2	0.011	0.017	N/A	0.037 C	N/A N/A N/A	CTDEP RSR FED-MCL CTDEP-MCL	NO	BSL

TABLE 2-2

OCCURRENCE, DISTRIBUTION, AND SELECTION OF COPCs IN GROUNDWATER AT SITE 3
DIRECT CONTACT EXPOSURE SCENARIOS
SITES 3, 7, 14, 15, 18, 20 GROUNDWATER RECORD OF DECISION
NSB-NLON, GROTON, CONNECTICUT
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CAS Number	Chemical	Minimum Concentration ⁽¹⁾	Minimum Qualifier	Maximum Concentration ⁽¹⁾	Maximum Qualifier	Units	Location of Maximum Concentration	Detection Frequency	Range of Nondetects ⁽²⁾	Concentration Used for Screening ⁽³⁾	Background Value ⁽⁴⁾	Risk-Based COPC Screening Level ⁽⁵⁾	Potential ARAR/TBC Value	Potential ARAR/TBC Source	COPC Flag ⁽⁶⁾	Rationale for Contaminant Deletion or Selection
Total Metals																
7429-90-5	Aluminum	732	J	6780	J	UG/L	S3GW3TW2701	2/3	25.4	6780	3560	3600 N	N/A 50 to 200	CTDEP RSR FED-SMCL CTDEP-MCL	NO	EPAI
7440-38-2	Arsenic	2	J	25.4		UG/L	S3GW2DMW29S04	2/8	1.2 - 2	25.4	1.92	0.045 C	50 10 50	CTDEP RSR FED-MCL CTDEP-MCL	YES	ASL
7440-39-3	Barium	30		74.8		UG/L	S3GW3TW3001	3/3	N/A	74.8	227	260 N	1000 2000 2000	CTDEP RSR FED-MCL CTDEP-MCL	NO	BSL, BKG
7440-70-2	Calcium	13300		19100		UG/L	S3GW3TW3001	3/3	N/A	19100	188000	N/A	N/A N/A N/A	CTDEP RSR FED-MCL CTDEP-MCL	NO	NUT, BKG
7440-47-3	Chromium ⁽⁷⁾	5.8		8.4		UG/L	S3GW3TW2701	2/3	0.55 - 2	8.4	49.9	11 N	N/A 100 N/A	CTDEP RSR FED-MCL CTDEP-MCL	NO	BSL, BKG
7440-50-8	Copper	4.3		14.2		UG/L	S3GW3TW2801	2/3	3.4	14.2	107	150 N	1300 1300 N/A	CTDEP RSR FED-MCL CTDEP-MCL	NO	BSL, BKG
7439-89-6	Iron	18000		20000		UG/L	S3GW3TW2801	2/3	14.6	20000	28200	1100 N	N/A 300 N/A	CTDEP RSR FED-SMCL CTDEP-MCL	NO	BKG, EPAI
7439-92-1	Lead	2.2		8.4		UG/L	S3GW3TW2701	2/3	1.3	8.4	6.63	N/A	15 15 N/A	CTDEP RSR FED-AL CTDEP-MCL	NO	BSL
7439-95-4	Magnesium	4410		5770		UG/L	S3GW3TW3001	3/3	N/A	5770	191000	N/A	N/A N/A N/A	CTDEP RSR FED-MCL CTDEP-MCL	NO	NUT, BKG
7439-96-5	Manganese	56.7		764		UG/L	S3GW3TW2701	3/3	N/A	764	11700	88 N	N/A 50 N/A	CTDEP RSR FED-SMCL CTDEP-MCL	NO	BKG
7440-09-7	Potassium	3650		4540		UG/L	S3GW3TW2801-D	3/3	N/A	4540	70800	N/A	N/A N/A N/A	CTDEP RSR FED-MCL CTDEP-MCL	NO	NUT, BKG
7440-23-5	Sodium	52400		68800		UG/L	S3GW3TW3001	3/3	N/A	68800	1900000	N/A	N/A N/A N/A	CTDEP RSR FED-MCL CTDEP-MCL	NO	NUT, BKG
7440-62-2	Vanadium	12.1		12.1		UG/L	S3GW3TW2701/ S3GW3TW2801	2/3	4.5	12.1	10.2	26 N	50 N/A N/A	CTDEP RSR FED-MCL CTDEP-MCL	NO	BSL
Filtered Metals																
7440-38-2	Arsenic-Filtered	2	J	3.5		UG/L	S3GW2DMW29S04-F	2/8	1.2 - 2	3.5	2.55	0.045 C	50 10 50	CTDEP RSR FED-MCL CTDEP-MCL	YES	ASL
7440-39-3	Barium-Filtered	23.1		75.6		UG/L	S3GW3TW3001-F	3/3	N/A	75.6	124	260 N	1000 2000 2000	CTDEP RSR FED-MCL CTDEP-MCL	NO	BSL, BKG
7440-70-2	Calcium-Filtered	13800		19100		UG/L	S3GW3TW3001-F	3/3	N/A	19100	152000	N/A	N/A N/A N/A	CTDEP RSR FED-MCL CTDEP-MCL	NO	NUT, BKG
7439-89-6	Iron-Filtered	12000		15200		UG/L	S3GW3TW2801-F-D	2/3	14.1	15200	25300	1100 N	N/A 300 N/A	CTDEP RSR FED-SMCL CTDEP-MCL	NO	BKG, EPAI
7439-95-4	Magnesium-Filtered	3730		5810		UG/L	S3GW3TW3001-F	3/3	N/A	5810	150000	N/A	N/A N/A N/A	CTDEP RSR FED-MCL CTDEP-MCL	NO	NUT, BKG
7439-96-5	Manganese-Filtered	58.6		496		UG/L	S3GW3TW2701-F	3/3	N/A	496	9400	88 N	N/A 50 N/A	CTDEP RSR FED-SMCL CTDEP-MCL	NO	BKG
7440-09-7	Potassium-Filtered	3650		4870		UG/L	S3GW3TW2801-F-D	3/3	N/A	4870	60000	N/A	N/A N/A N/A	CTDEP RSR FED-MCL CTDEP-MCL	NO	NUT, BKG
7440-23-5	Sodium-Filtered	55600		69400		UG/L	S3GW3TW3001-F	3/3	N/A	69400	1580000	N/A	N/A N/A N/A	CTDEP RSR FED-MCL CTDEP-MCL	NO	NUT, BKG

TABLE 2-2

OCCURRENCE, DISTRIBUTION, AND SELECTION OF COPCS IN GROUNDWATER AT SITE 3
DIRECT CONTACT EXPOSURE SCENARIOS
SITES 3, 7, 14, 15, 18, 20 GROUNDWATER RECORD OF DECISION
NSB-NLON, GROTON, CONNECTICUT
PAGE 3 OF 3

CAS Number	Chemical	Minimum Concentration ⁽¹⁾	Minimum Qualifier	Maximum Concentration ⁽¹⁾	Maximum Qualifier	Units	Location of Maximum Concentration	Detection Frequency	Range of Nondetects ⁽²⁾	Concentration Used for Screening ⁽³⁾	Background Value ⁽⁴⁾	Risk-Based COPC Screening Level ⁽⁵⁾	Potential ARAR/TBC Value	Potential ARAR/TBC Source	COPC Flag ⁽⁶⁾	Rationale for Contaminant Deletion or Selection
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From Basewide Groundwater Operable Unit Remedial Investigation Update/Feasibility Study Report (TINUS, 2004).

A shaded value indicates that the concentration used for screening exceeds the criterion or background value.

A shaded chemical name indicates that the chemical has been selected as a COPC.

Footnotes:

- 1 Sample and duplicate are counted as two separate samples when determining the minimum and maximum detected concentrations.
- 2 Values presented are sample-specific quantitation limits.
- 3 The maximum detected concentration is used for screening purposes.
- 4 95% Upper Tolerance Limit (UTL) of site background data.
- 5 The risk-based COPC screening level for tap water use is presented. The value is based on a target Hazard Quotient of 0.1 for noncarcinogens (denoted with a "N" flag) or an incremental cancer risk of 1E-6 for carcinogens (denoted with a "C" flag) (EPA, 2002b). The PRG for noncarcinogenic compounds are divided by 10.
- 6 The chemical is selected as a COPC if the maximum detected concentration exceeds the background value and the risk-based COPC screening level and/or an ARAR/TBC(s).
- 7 Hexavalent chromium.

Associated Samples:

S3GW2DMW23D02
S3GW2DMW23D02-F
S3GW2DMW28D02
S3GW2DMW28D02-F
S3GW2DMW29S04
S3GW2DMW29S04-F
S3GW2DMW30S04
S3GW2DMW30S04-F
S3GW3MW14S02
S3GW3MW14S02-F
S3GW3TW2701
S3GW3TW2701-F
S3GW3TW2801
S3GW3TW2801-D
S3GW3TW2801-F
S3GW3TW2801-F-D
S3GW3TW3001
S3GW3TW3001-F

Definitions:

ARAR/TBC = Applicable or Relevant and Appropriate Requirement/To Be Considered.

C = Carcinogen.

COPC = Chemical of Potential Concern.

J = Estimated Value.

N = Noncarcinogen.

N/A = Not Applicable.

FED-MCL = Federal Maximum Contaminant Level (EPA, 2002a).

FED-SMCL = Federal Secondary Maximum Contaminant Level (EPA, 2002a).

FED-AL = Federal Action Level (EPA, 2002a).

CTDEP-RSR = Connecticut DEP RSR - Residential, 1996.

CTDEP-MCL = Connecticut Department of Public Health Maximum Contaminant Level.

Rationale Codes:

For Selection as a COPC:

ASL = Above COPC Screening Level/ARAR/TBC.

For Elimination as a COPC:

BKG = Less than Background Levels.

BSL = Below COPC Screening Level/ARAR/TBC.

NUT = Essential Nutrient.

NTX = No Toxicity Information.

EPAL = USEPA Region 1 does not advocate evaluation of this chemical.

TABLE 2-3

OCCURRENCE, DISTRIBUTION, AND SELECTION OF CHEMICALS OF POTENTIAL CONCERN IN GROUNDWATER AT SITE 3
MIGRATION PATHWAYS
SITES 3, 7, 14, 15, 18, 20 GROUNDWATER RECORD OF DECISION
NSB-NLON, GROTON, CONNECTICUT
PAGE 1 OF 2

Scenario Timeframe: Future
Medium: Groundwater
Exposure Medium: Groundwater
Exposure Point: Site 3

CAS Number	Chemical	Minimum Concentration ⁽¹⁾	Minimum Qualifier	Maximum Concentration ⁽¹⁾	Maximum Qualifier	Units	Location of Maximum Concentration	Detection Frequency	Range of Nondetects ⁽²⁾	Concentration Used for Screening ⁽³⁾	Background Value ⁽⁴⁾	CTDEP Surface Water Criteria ⁽⁵⁾	CTDEP Vol. Criteria ⁽⁶⁾	COPC Flag ⁽⁷⁾	Rationale for Contaminant Deletion or Selection
Volatile Organic Compounds															
79-00-5	1,1,2-Trichloroethane	2	J	2	J	UG/L	S3GW3TW2701	1/8	1	2	N/A	1260	8000	NO	BSL
75-15-0	Carbon Disulfide	0.2	J	0.2	J	UG/L	S3GW2DMW23D02	1/8	1	0.2	N/A	N/A	N/A	NO	NTX
67-66-3	Chloroform	0.4	J	0.9	J	UG/L	S3GW2DMW23D02	2/8	1	0.9	N/A	14100	287	NO	BSL
156-59-2	cis-1,2-Dichloroethene	0.7	J	3		UG/L	S3GW2DMW29S04/ S3GW3TW2801-D	4/8	1	3	N/A	N/A	N/A	NO	NTX
108-88-3	Toluene	0.2	J	0.3	J	UG/L	S3GW3TW2701/ S3GW3TW2801	2/8	1	0.3	N/A	4000000	23500	NO	BSL
540-59-0	Total 1,2-Dichloroethene	0.7	J	3		UG/L	S3GW2DMW29S04	2/5	1	3	N/A	N/A	N/A	NO	NTX
156-60-5	trans-1,2-Dichloroethene	0.2	J	0.2	J	UG/L	S3GW3TW2801/ S3GW3TW2801-D	1/8	1	0.2	N/A	N/A	N/A	NO	NTX
79-01-6	Trichloroethene	0.5	J	2		UG/L	S3GW3TW2801-D	3/8	1	2	N/A	2340	219	NO	BSL
75-01-4	Vinyl Chloride	0.3	J	2	J	UG/L	S3GW3TW2701	3/8	1	2	N/A	15750	2	NO	BSL
Semivolatile Organic Compounds															
83-32-9	Acenaphthene	0.11	J	0.13	J	UG/L	S3GW3TW2801/ S3GW3TW2801-D	2/8	0.2	0.13	N/A	N/A	N/A	NO	NTX
50-32-8	Benzo(a)pyrene	0.13	J	0.13	J	UG/L	S3GW3TW2801	1/8	0.2	0.13	N/A	0.3	N/A	NO	BSL
191-24-2	Benzo(g,h,i)perylene	0.28		0.28		UG/L	S3GW3TW2801	1/8	0.2	0.28	N/A	N/A	N/A	NO	NTX
207-08-9	Benzo(k)fluoranthene	0.08	J	0.08	J	UG/L	S3GW3TW2801	1/8	0.2	0.08	N/A	0.3	N/A	NO	BSL
53-70-3	Dibenzo(a,h)anthracene	0.3		0.3		UG/L	S3GW3TW2801	1/8	0.2	0.3	N/A	N/A	N/A	NO	NTX
86-73-7	Fluorene	0.24	J	0.36	J	UG/L	S3GW3TW2801	2/8	0.2	0.36	N/A	140000	N/A	NO	BSL
193-39-5	Indeno(1,2,3-cd)pyrene	0.35		0.35		UG/L	S3GW3TW2801	1/8	0.2	0.35	N/A	N/A	N/A	NO	NTX
Pesticides/PCBs															
319-84-6	alpha-BHC	0.025		0.028		UG/L	S3GW3TW2801	1/3	0.01 - 0.011	0.028	N/A	N/A	N/A	NO	NTX
319-85-7	beta-BHC	0.015	J	0.017		UG/L	S3GW3TW2801-D	1/2	0.011	0.017	N/A	N/A	N/A	NO	NTX
Total Metals															
7429-90-5	Aluminum	732	J	6780	J	UG/L	S3GW3TW2701	2/3	25.4	6780	3560	N/A	N/A	NO	NTX
7440-38-2	Arsenic	2	J	25.4		UG/L	S3GW2DMW29S04	2/8	1.2 - 2	25.4	1.92	4	N/A	YES	ASL
7440-39-3	Barium	30		74.8		UG/L	S3GW3TW3001	3/3	N/A	74.8	227	N/A	N/A	NO	NTX, BKG
7440-70-2	Calcium	13300		19100		UG/L	S3GW3TW3001	3/3	N/A	19100	188000	N/A	N/A	NO	NUT, BKG
7440-47-3	Chromium ⁽⁶⁾	5.8		8.4		UG/L	S3GW3TW2701	2/3	0.55 - 2	8.4	49.9	110	N/A	NO	BSL, BKG
7440-50-8	Copper	4.3		14.2		UG/L	S3GW3TW2801	2/3	3.4	14.2	107	48	N/A	NO	BSL, BKG
7439-89-6	Iron	18000		20000		UG/L	S3GW3TW2801	2/3	14.6	20000	28200	N/A	N/A	NO	NTX, BKG
7439-92-1	Lead	2.2		8.4		UG/L	S3GW3TW2701	2/3	1.3	8.4	6.63	13	N/A	NO	BSL
7439-95-4	Magnesium	4410		5770		UG/L	S3GW3TW3001	3/3	N/A	5770	191000	N/A	N/A	NO	NUT, BKG
7439-96-5	Manganese	56.7		764		UG/L	S3GW3TW2701	3/3	N/A	764	11700	N/A	N/A	NO	NTX, BKG
7440-09-7	Potassium	3650		4540		UG/L	S3GW3TW2801-D	3/3	N/A	4540	70800	N/A	N/A	NO	NUT, BKG
7440-23-5	Sodium	52400		68800		UG/L	S3GW3TW3001	3/3	N/A	68800	1900000	N/A	N/A	NO	NUT, BKG
7440-62-2	Vanadium	12.1		12.1		UG/L	S3GW3TW2701/ S3GW3TW2801	2/3	4.5	12.1	10.2	N/A	N/A	NO	NTX
Filtered Metals															
7440-38-2	Arsenic-Filtered	2	J	3.5		UG/L	S3GW2DMW29S04-F	2/8	1.2 - 2	3.5	2.55	4	N/A	NO	BSL
7440-39-3	Barium-Filtered	23.1		75.6		UG/L	S3GW3TW3001-F	3/3	N/A	75.6	124	N/A	N/A	NO	NTX, BKG
7440-70-2	Calcium-Filtered	13800		19100		UG/L	S3GW3TW3001-F	3/3	N/A	19100	152000	N/A	N/A	NO	NUT, BKG
7439-89-6	Iron-Filtered	12000		15200		UG/L	S3GW3TW2801-F-D	2/3	14.1	15200	25300	N/A	N/A	NO	NTX, BKG
7439-95-4	Magnesium-Filtered	3730		5810		UG/L	S3GW3TW3001-F	3/3	N/A	5810	150000	N/A	N/A	NO	NUT, BKG
7439-96-5	Manganese-Filtered	58.6		496		UG/L	S3GW3TW2701-F	3/3	N/A	496	9400	N/A	N/A	NO	NTX, BKG
7440-09-7	Potassium-Filtered	3650		4870		UG/L	S3GW3TW2801-F-D	3/3	N/A	4870	60000	N/A	N/A	NO	NUT, BKG
7440-23-5	Sodium-Filtered	55600		69400		UG/L	S3GW3TW3001-F	3/3	N/A	69400	1580000	N/A	N/A	NO	NUT, BKG

TABLE 2-3

OCCURRENCE, DISTRIBUTION, AND SELECTION OF CHEMICALS OF POTENTIAL CONCERN IN GROUNDWATER AT SITE 3
MIGRATION PATHWAYS
SITES 3, 7, 14, 15, 18, 20 GROUNDWATER RECORD OF DECISION
NSB-NLON, GROTON, CONNECTICUT
PAGE 2 OF 2

CAS Number	Chemical	Minimum Concentration ⁽¹⁾	Minimum Qualifier	Maximum Concentration ⁽¹⁾	Maximum Qualifier	Units	Location of Maximum Concentration	Detection Frequency	Range of Nondetects ⁽²⁾	Concentration Used for Screening ⁽³⁾	Background Value ⁽⁴⁾	CTDEP Surface Water Criteria ⁽⁵⁾	CTDEP Vol. Criteria ⁽⁶⁾	COPC Flag ⁽⁷⁾	Rationale for Contaminant Deletion or Selection
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From Basewide Groundwater Operable Unit Remedial Investigation Update/Feasibility Study Report (TiNUS, 2004).

A shaded value indicates that the concentration used for screening exceeds the criterion or background value.

A shaded chemical name indicates that the chemical has been selected as a COPC.

Footnotes:

- 1 Sample and duplicate are counted as two separate samples when determining the minimum and maximum detected concentrations.
- 2 Values presented are sample-specific quantitation limits.
- 3 The maximum detected concentration is used for screening purposes.
- 4 95% Upper Tolerance Limit (UTL) of site background data.
- 5 Connecticut DEP Surface Water Protection criteria.
- 6 Connecticut DEP Volatilization criteria for residential exposures.
- 7 The chemical is selected as a COPC if the maximum detected concentration exceeds the background value and the CTDEP surface water protection or volatilization criteria.
- 8 Hexavalent chromium.

Associated Samples:

S3GW2DMW23D02
S3GW2DMW23D02-F
S3GW2DMW28D02
S3GW2DMW28D02-F
S3GW2DMW29S04
S3GW2DMW29S04-F
S3GW2DMW30S04
S3GW2DMW30S04-F
S3GW3MW14S02
S3GW3MW14S02-F
S3GW3TW2701
S3GW3TW2701-F
S3GW3TW2801
S3GW3TW2801-D
S3GW3TW2801-F
S3GW3TW2801-F-D
S3GW3TW3001
S3GW3TW3001-F

Definitions:

ARAR/TBC = Applicable or Relevant and Appropriate Requirement/To Be Considered.

COPC = Chemical of Potential Concern.

J = Estimated Value.

N/A = Not Applicable.

Rationale Codes:

For Selection as a COPC:

ASL = Above COPC Screening Level/ARAR/TBC.

For Elimination as a COPC:

BKG = Less than Background Levels.

BSL = Below COPC Screening Level/ARAR/TBC.

NTX = No Toxicity Information.

NUT = Essential Nutrient.

TABLE 2-4

TRENDS OF TCE AND DEGRADATION COMPOUNDS IN GROUNDWATER AT SITES 3, 6, AND 7 (µg/L)
 SITES 3, 7, 14, AND 20 GROUNDWATER RECORD OF DECISION
 NSB-NLON, GROTON, CONNECTICUT
 PAGE 1 OF 5

SITE 3

Sample Date	1,1-DCE	cis-1,2-DCE	trans-1,2-DCE	total-1,2-DCE	TCE	Vinyl Chloride
2DMW10D						
1/7/1991 ⁽¹⁾	5 U	NA	NA	5 U	5 U	10 U
3/31/1994	10 U	NA	NA	10 U	10 U	10 U
7/11/1994	10 U	NA	NA	10 U	10 U	10 U
8/2/2000	1 U	1 U	1 U	NA	1.88	1 U
2DMW23D						
3/21/1994	10 U	NA	NA	10 U	10 U	10 U
6/22/1994	10 U	NA	NA	10 U	10 U	10 U
7/25/2000	1 U	1 U	1 U	NA	2.2	1 U
10/16/2002	1 U	1 U	1 U	1 U	1 U	1 U
2DMW26D						
3/17/1994 ⁽¹⁾	10 U	NA	NA	10 U	10 U	10 U
7/8/1994	10 U	NA	NA	10 U	10 U	10 U
7/22/2000	1 U	1 U	1 U	NA	1 U	1 U
2DMW26S						
3/17/1994	10 U	NA	NA	10 U	10 U	10 U
7/8/1994	10 U	NA	NA	10 U	10 U	10 U
7/22/2000	1 U	1 U	1 U	NA	2.41 J	1 U
2DMW28D						
3/17/1994	10 U	NA	NA	10 U	10 U	10 U
6/26/1994	10 U	NA	NA	10 U	10 U	10 U
7/23/2000	1 U	1 U	1 U	NA	8.76 J	1 U
10/15/2002	1 U	1 U	1 U	1 U	1 U	1 U
2DMW28S						
3/17/1994	10 U	NA	NA	10 U	10 U	10 U
6/25/1994	10 U	NA	NA	10 U	10 U	10 U
7/23/2000	1 U	1 U	1 U	NA	1 U	1 U
2DMW29S						
1/23/1994	10 U	NA	NA	28	10 U	130
7/12/1994	10 U	NA	NA	11 J	10 U	29 J
6/23/2000	1 U	6.79	1 U	NA	1 U	3.67

TABLE 2-4

TRENDS OF TCE AND DEGRADATION COMPOUNDS IN GROUNDWATER AT SITES 3, 6, AND 7 (µg/L)
 SITES 3, 7, 14, AND 20 GROUNDWATER RECORD OF DECISION
 NSB-NLON, GROTON, CONNECTICUT
 PAGE 2 OF 5

Sample Date	1,1-DCE	cis-1,2-DCE	trans-1,2-DCE	total-1,2-DCE	TCE	Vinyl Chloride
7/12/2000	1 U	12	1 U	NA	5.47	31.3
10/15/2002	1 U	3	1 U	3	1 U	0.3 J
3MW14S						
7/25/2000	1 U	1 U	1 U	NA	6.22	1 U
10/15/2002	1 U	1 U	1 U	1 U	1 U	1 U
3TW01						
6/10/2000	1 U	2	1 U	NA	1 U	5
3TW27						
10/25/2002	1 U	1 J	1 U	NA	1 J	2 J
3TW28						
10/25/2002	1 U	2.5 J	0.2 J	NA	1.5 J	0.35 J
3TW30						
10/25/2002	1 U	1 U	1 U	NA	1 U	1 U
SITE 6 (Downgradient)						
6MW1S						
12/18/1990	5 U	NA	NA	5 U	5 U	10 U
1/11/1994	10 U	NA	NA	10 U	10 U	10 U
6/24/1994	10 U	NA	NA	10 U	10 U	10 U
4/21/1998	1 U	1 U	1 U	NA	0.6 J	1 U
8/3/1998	1 U	1 U	1 U	NA	1 U	1 U
1/28/1999	1 U	1 U	1 U	NA	1 U	1 U
4/23/1999	1 U	1 U	1 U	NA	1 U	1 U
7/22/1999	1 U	1 U	1 U	NA	0.44 J	1 U
10/24/1999	1 U	1 U	1 U	NA	0.4 J	1 U
1/21/2000	1 U	1 U	1 U	NA	1 U	1 U
4/11/2000	1 U	1 U	1 U	NA	0.5 J	1 U
7/27/2000	1 U	1 U	1 U	NA	1 J	1 U
12/19/2000	1 U	1 U	1 U	NA	0.34 J	1 U
3/10/2001	1 U	1 U	1 U	NA	0.27 J	1 U
6/23/2001	1 U	1 U	1 U	NA	1 U	1 U
9/24/2001	1 U	1 U	1 U	NA	1 U	1 U
9/18/2002	1 U	1 U	1 U	NA	0.5 J	1 U

TABLE 2-4

TRENDS OF TCE AND DEGRADATION COMPOUNDS IN GROUNDWATER AT SITES 3, 6, AND 7 (µg/L)
 SITES 3, 7, 14, AND 20 GROUNDWATER RECORD OF DECISION
 NSB-NLON, GROTON, CONNECTICUT
 PAGE 3 OF 5

Sample Date	1,1-DCE	cis-1,2-DCE	trans-1,2-DCE	total-1,2-DCE	TCE	Vinyl Chloride
6MW2S						
12/18/1990	5 U	NA	NA	1 J	4 J	10 U
1/11/1994	10 U	NA	NA	10 U	10 U	10 U
6/24/1994	10 U	NA	NA	10 U	10 U	10 U
4/21/1998	1 U	0.8 J	1 U	NA	0.6 J	1 U
7/31/1998	1 U	1 U	1 U	NA	1 U	1 U
1/28/1999	1 U	0.5 J	1 U	NA	1 U	1 U
4/21/1999 ⁽¹⁾	1 U	1 U	1 U	NA	1 U	1 U
7/21/1999	1 U	0.24 J	1 U	NA	0.44 J	1 U
10/23/1999	1 U	0.3 J	1 U	NA	0.3 J	1 U
1/20/2000	1 U	1 U	1 U	NA	1 U	1 U
4/11/2000	1 U	0.4 J	1 U	NA	0.4 J	1 U
7/27/2000	1 U	1 U	1 U	NA	1 U	1 U
12/18/2000	1 U	0.12 J	1 U	NA	0.2 J	1 U
3/7/2001	1 U	1 U	1 U	NA	0.13 J	1 U
6/21/2001	1 UJ	1 U	1 U	NA	1 U	1 U
9/23/2001	1 U	1 U	1 U	NA	1 U	1 U
9/19/2002	1 U	0.2 J	1 U	NA	0.6 J	1 U
6MW6D						
3/4/1994	10 U	NA	NA	10 U	10 U	10 U
6/22/1994 ⁽¹⁾	10 U	NA	NA	10 U	3.5 J	10 U
4/22/1998	1 U	7	1 U	NA	7	1 U
7/29/1998	1 U	6	1 U	NA	8	1 U
1/25/1999	1 U	14	1 U	NA	7	1 U
4/19/1999	1 U	6	1 U	NA	7	1 U
7/19/1999	1 U	6.6	1 U	NA	10	1 U
10/21/1999	1 U	6	1 U	NA	11	1 U
1/18/2000	1 U	5	1 U	NA	9	1 U
4/10/2000	1 U	5	1 U	NA	10	1 U
7/23/2000	1 U	7	1 U	NA	10	1 U
12/15/2000	1 U	5.3	1 U	NA	10	1 U
3/6/2001 ⁽¹⁾	1 U	3.35	1 U	NA	5.8	1 U

TABLE 2-4

TRENDS OF TCE AND DEGRADATION COMPOUNDS IN GROUNDWATER AT SITES 3, 6, AND 7 (µg/L)
 SITES 3, 7, 14, AND 20 GROUNDWATER RECORD OF DECISION
 NSB-NLON, GROTON, CONNECTICUT
 PAGE 4 OF 5

Sample Date	1,1-DCE	cis-1,2-DCE	trans-1,2-DCE	total-1,2-DCE	TCE	Vinyl Chloride
6/25/2001	1 U	5.5	1 U	NA	7.6	1 U
9/20/2001	1 U	4.7	1 U	NA	7.2 J	1 U
9/18/2002 ⁽¹⁾	1 U	5.5	1 U	NA	9.5	1 U
6MW6S						
3/4/1994	10 U	NA	NA	10 U	10 U	10 U
6/24/1994	10 U	NA	NA	10 U	10 U	10 U
4/21/1998	1 U	1 U	1 U	NA	1 U	1 U
7/29/1998	1 U	1 U	1 U	NA	1 U	1 U
1/25/1999	1 U	1 U	1 U	NA	1 U	1 U
4/19/1999	1 U	1 U	1 U	NA	1 U	1 U
7/19/1999	1 U	1 U	1 U	NA	0.59 J	1 U
10/21/1999 ⁽¹⁾	1 U	1 U	1 U	NA	0.5 J	1 U
1/18/2000	1 U	1 U	1 U	NA	0.5 J	1 U
4/10/2000 ⁽¹⁾	1 U	1 U	1 U	NA	0.3 J	1 U
7/23/2000	1 U	1 U	1 U	NA	0.5 J	1 U
12/15/2000 ⁽¹⁾	1 U	0.185 J	1 U	NA	0.78 J	1 U
3/6/2001	1 U	1 U	1 U	NA	0.25 J	1 U
6/25/2001 ⁽¹⁾	1 U	1 U	1 U	NA	1 U	1 U
9/20/2001 ⁽¹⁾	1 U	1 U	1 U	NA	0.6 J	1 U
9/18/2002	1 U	0.3 J	1 U	NA	1	1 U
SITE 7 (Upgradient)						
7MW1D						
12/7/1990 ⁽¹⁾	5 U	NA	NA	5 U	5 U	10 U
3/31/1994	10 U	NA	NA	10 U	10 U	10 U
7/6/1994	10 U	NA	NA	10 U	10 U	10 U
7/7/2000	1 U	1 U	1 U	NA	4.09	1 UJ
7MW2D						
4/5/1994	10 U	NA	NA	10 U	10 U	10 U
7/7/1994	10 U	NA	NA	10 U	10 U	10 U
7/8/2000	1 U	1 U	1 U	NA	1.54	1 UJ

TABLE 2-4

TRENDS OF TCE AND DEGRADATION COMPOUNDS IN GROUNDWATER AT SITES 3, 6, AND 7 (µg/L)
SITES 3, 7, 14, AND 20 GROUNDWATER RECORD OF DECISION
NSB-NLON, GROTON, CONNECTICUT
PAGE 5 OF 5

Sample Date	1,1-DCE	cis-1,2-DCE	trans-1,2-DCE	total-1,2-DCE	TCE	Vinyl Chloride
7MW5D						
4/6/1994	10 U	NA	NA	10 U	10 U	10 U
7/8/1994	10 U	NA	NA	10 U	10 U	10 U
7/11/2000	1 U	1 U	1 U	NA	7.58	1 UJ
7MW7S						
4/4/1994	10 U	NA	NA	10 U	10 U	10 U
7/6/1994	10 U	NA	NA	10 U	10 U	10 U
7/10/2000	1 U	1 U	1 U	NA	2.03	1 U
7MW8S						
3/29/1994	10 U	NA	NA	10 U	10 U	10 U
7/7/1994	10 U	NA	NA	10 U	10 U	10 U
7/8/2000	1 U	1 U	1 U	NA	1 U	1 UJ
7MW9S						
3/29/1994 ⁽¹⁾	10 U	NA	NA	10 U	10 U	10 U
7/8/1994	10 U	NA	NA	10 U	10 U	10 U
7/11/2000	1 U	1 U	1 U	NA	23	1 U
B325-MW1						
7/9/2000	1 U	1 U	1 U	NA	1.93	1 UJ
B325-MW3						
7/9/2000	1 U	1 U	1 U	NA	1.39	1 UJ

From Basewide Groundwater Operable Unit Remedial Investigation Update/Feasibility Study Report (TtNUS, 2004).

NOTES:

- 1 The reported result is an average of the original sample and its duplicate.
- NA Not analyzed.
- U Parameter not detected. The value reported is the detection limit.
- J Estimated value.

TABLE 2-5

SUMMARY OF POSITIVE GROUNDWATER ANALYTICAL RESULTS FOR TEMPORARY WELLS AT SITE 7
SITES 3, 7, 14, 15, 18, AND 20 GROUNDWATER RECORD OF DECISION
NSB-NLON, GROTON, CONNECTICUT
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location sample sacode sample_dat	7TW1 S7TW0101 NORMAL 6/11/2000	7TW2 S7TW0201 NORMAL 6/11/2000	7TW3 S7TW0301 NORMAL 6/11/2000	7TW4 S7TW0401 NORMAL 6/11/2000	7TW5 S7TW0501 NORMAL 6/11/2000	7TW6 S7TW0601 NORMAL 6/11/2000	7TW7 S7TW0701 DUP 6/11/2000	7TW7 FD0611001 DUP 6/11/2000	7TW8 S7TW0801 NORMAL 6/24/2000	7TW9 S7TW0901 NORMAL 6/24/2000	7TW10 S7TW1001 NORMAL 6/25/2000
Volatile Organics (ug/L)											
1,4-DICHLOROBENZENE	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1.83	9.21	90.5 J
BENZENE	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	2 J
CHLOROBENZENE	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	6.66	165 J
Dissolved Gases (ug/L)											
METHANE									19	8	6
Semivolatile Organics (ug/L)											
BIS(2-ETHYLHEXYL)PHTHALATE									44	49	5 U
Total Metals (ug/L)											
ALUMINUM									891	57500	50.5 U
ARSENIC									2.3 U	11.4	2.3 U
BARIUM									38.6 U	434	20.5 U
CALCIUM									23900	37000	12800
CHROMIUM									6.2 U	127	6.2 U
COBALT									4.2 U	31.3	4.2 U
COPPER									6.8 U	73.2	6.8 U
IRON									4370	59400	282 U
LEAD									1.8 U	32.8	1.8 U
MAGNESIUM									5130	19500	3080
MANGANESE									836	1250	650
NICKEL									9.2 U	52.8 J	9.2 U
POTASSIUM									6060	11600	4410
SILVER									5.2 U	16.3	5.2 U
SODIUM									64100	67500	29600
VANADIUM									6.3 U	151	6.3 U
ZINC									21 U	164	15.6 U

TABLE 2-5

**SUMMARY OF POSITIVE GROUNDWATER ANALYTICAL RESULTS FOR TEMPORARY WELLS AT SITE 7
SITES 3, 7, 14, 15, 18, AND 20 GROUNDWATER RECORD OF DECISION
NSB-NLON, GROTON, CONNECTICUT
PAGE 2 OF 2**

location	7TW1	7TW2	7TW3	7TW4	7TW5	7TW6	7TW7	7TW7	7TW8	7TW9	7TW10
sample	S7TW0101	S7TW0201	S7TW0301	S7TW0401	S7TW0501	S7TW0601	S7TW0701	FD0611001	S7TW0801	S7TW0901	S7TW1001
sacode	NORMAL	NORMAL	NORMAL	NORMAL	NORMAL	NORMAL	DUP	DUP	NORMAL	NORMAL	NORMAL
sample_dat	6/11/2000	6/11/2000	6/11/2000	6/11/2000	6/11/2000	6/11/2000	6/11/2000	6/11/2000	6/24/2000	6/24/2000	6/25/2000
Miscellaneous Parameters (mg/L)											
ALKALINITY									82.6	76.4	50.3
AMMONIA, AS NITROGEN									0.43	0.43	0.2
AMMONIUM									0.44	0.3	0.3
CHLORIDE									92	69.8	41.2
HARDNESS as CaCO ₃									80.7	173	44.7
PERCHLORATE									0.004 U	0.004 U	0.004 U
SULFATE									29.8	34.6	13.9
SULFIDE									0.05 U	0.05 U	0.07
TOTAL DISSOLVED SOLIDS									275	266	158
TOTAL ORGANIC CARBON									14	17	9
TOTAL SUSPENDED SOLIDS									29	2950	5 U

Taken from Basewide Groundwater Operable Unit Remedial Investigation (TtNUS, 2002a).

TABLE 2-6

SUMMARY OF GROUNDWATER ANALYTICAL RESULTS FOR PERMANENT WELLS AT SITE 7
SITES 3, 7, 14, 15, 18, AND 20 GROUNDWATER RECORD OF DECISION
NSB-NLON, GROTON, CONNECTICUT
PAGE 1 OF 6

location sample sacode sample_dat Aquifer	B325-MW1 S7B325MW0101 NORMAL 7/9/2000 Overburden	B325-MW3 S7B325MW0301 NORMAL 7/9/2000 Overburden	B325-MW4 S7B325MW0401 NORMAL 7/10/2000 Overburden	7MW1D S7MW01D01 NORMAL 7/7/2000 Bedrock	7MW1D S7MW01D01-F NORMAL 7/7/2000	7MW2D S7MW02D01 NORMAL 7/8/2000 Becrodk	7MW2S S7MW02S01 NORMAL 7/8/2000 Overburden	7WM3D S7MW03D01 NORMAL 6/24/2000 Overburden	7MW3S S7MW03S01 NORMAL 7/11/2000 Overburden
Volatile Organics (ug/L)									
1,3-DICHLOROBENZENE	1 U	1 U	1 U	1 U		1 U	1 U	1 UJ	1.73
1,4-DICHLOROBENZENE	1 U	1 U	1 U	1 U		1 U	1 U	1 UJ	1.71
TRICHLOROETHENE	1.93	1.39	1 U	4.09		1.54	1 U	1 UJ	1 U
Dissolved Gases (ug/L)									
METHANE	1 U	1 U	1 UJ	1 U		1 U	1 U	1	20 J
Semivolatile Organics (ug/L)									
BIS(2-ETHYLHEXYL)PHTHALATE	5 U	5 U	10 U	5 U		5 U	5 U	5 U	5 U
FLUORENE	0.05 U	0.05 U	0.1 U	0.05 U		0.05 U	0.05 U	0.1 U	0.1 U
HEXACHLOROBENZENE	5 U	5 U	10 U	5 U		5 U	5 U	5 U	5 U
PHENANTHRENE	0.03 U	0.03 U	0.05 U	0.03 U		0.03 U	0.03 U	0.05 U	0.05 U
Total Metals (ug/L)									
ALUMINUM	72.4 J	246	815	50.5 U		93.9 J	105	1140	50.5 U
ARSENIC	2.3 U	2.3 U	2.3 U	2.3 U		2.3 U	2.3 U	2.3 U	2.3 U
BARIUM	39	35.7	21 U	17.7 U		9.3 U	9.3 U	39.9	33.5
CADMIUM	0.25 U	0.25 U	0.25 U	0.25 U		0.25 U	0.25 U	0.25 U	0.27 J
CALCIUM	26000	23400	20500	15100		8350	5480	21900	17000
CHROMIUM	6.2 U	6.2 U	7.6 J	8.8 U		6.2 U	6.2 U	11.7 J	6.2 U
COBALT	4.4 J	4.2 U	5.3 J	4.2 U		4.2 U	14.5	13.9 U	7.1 J
COPPER	11.5 U	6.8 U	10.7 J	11.6 U		10.5 U	6.8 U	6.8 U	11.8 J
IRON	101 U	196 U	648	759 U		75.4 U	13500 J	1440	119 U
LEAD	6.7	1.8 U	1.8 U	7.8		4.2	1.8 U	1.8 U	1.8 U
MAGNESIUM	6170 J	5350 J	3070	1230 J		1420 J	1250 J	8560	5810
MANGANESE	33.2 J	9.2 J	35	9.3 J		2.7 UJ	295 J	958	748
NICKEL	9.2 U	9.2 U	9.2 U	9.2 U		9.2 U	9.2 U	9.2 U	9.2 U
POTASSIUM	7010	7140	6090	1460		1290	1310	4900	3010
SELENIUM	2.8 U	2.8 U	2.8 U	2.8 U		2.8 U	2.8 U	2.8 U	2.8 U
SODIUM	76600	76000	44600	4020		7280	5240	91600	76500
VANADIUM	6.3 U	6.3 U	6.3 U	6.3 U		6.3 U	6.3 U	6.3 U	6.3 U
ZINC	18.1 U	12.8 U	20.5	157 J		17.3 U	7.4 U	16.4 U	17.1

TABLE 2-6

SUMMARY OF GROUNDWATER ANALYTICAL RESULTS FOR PERMANENT WELLS AT SITE 7
SITES 3, 7, 14, 15, 18, AND 20 GROUNDWATER RECORD OF DECISION
NSB-NLON, GROTON, CONNECTICUT
PAGE 2 OF 6

location	B325-MW1	B325-MW3	B325-MW4	7MW1D	7MW1D	7MW2D	7MW2S	7WM3D	7MW3S
sample	S7B325MW0101	S7B325MW0301	S7B325MW0401	S7MW01D01	S7MW01D01-F	S7MW02D01	S7MW02S01	S7MW03D01	S7MW03S01
sacode	NORMAL	NORMAL	NORMAL	NORMAL	NORMAL	NORMAL	NORMAL	NORMAL	NORMAL
sample_dat	7/9/2000	7/9/2000	7/10/2000	7/7/2000	7/7/2000	7/8/2000	7/8/2000	6/24/2000	7/11/2000
Aquifer	Overburden	Overburden	Overburden	Bedrock		Becrodk	Overburden	Overburden	Overburden
Dissolved Metals (ug/L)									
BARIUM					18.7 U				
CALCIUM					17600				
COPPER					6.8 U				
MAGNESIUM					1470				
MANGANESE					7.8 J				
POTASSIUM					1730				
SODIUM					4690				
ZINC					173				
Miscellaneous Parameters (mg/L)									
ALKALINITY	68.5 J	67 J	66.5 J	39.7 J		19 J	15.5 J	59.2	75.7
AMMONIA			0.18 J						0.16
AMMONIA, AS NITROGEN	0.11	0.1 U		0.54 J		0.13	0.14	0.22	
AMMONIUM	0.2 U	0.2 U	0.2 U	0.2 U		0.2 U	0.2 U	0.4	0.2 U
CHLORIDE	96.8 J	95 J	59.5	5.84 J		8.84 J	8.26 J	104	85.1
HARDNESS as CaCO3	90.3	80.4	63.8	42.8		26.7	18.8	89.8	66.4
SULFATE	49.9 J	43 J	21.5	14.1 J		13.5 J	16.3 J	65.4	48.9
TOTAL DISSOLVED SOLIDS	158 U	302 J	211 J	111 U		66.2 U	90 U	355	289
TOTAL ORGANIC CARBON	5 U	5 U	3.5	6		5 U	6	8	1.4
TOTAL SUSPENDED SOLIDS	5 UJ	26 J	41 J	5 UJ		5 UJ	10 J	57	5 U

TABLE 2-6

SUMMARY OF GROUNDWATER ANALYTICAL RESULTS FOR PERMANENT WELLS AT SITE 7
SITES 3, 7, 14, 15, 18, AND 20 GROUNDWATER RECORD OF DECISION
NSB-NLON, GROTON, CONNECTICUT
PAGE 3 OF 6

location sample sacode sample_dat Aquifer	7MW4S S7MW04S01 NORMAL 7/9/2000 Bedrock	7MW5D S7MW05D01 NORMAL 7/11/2000 Bedrock	7MW5S S7MW05S01 DUP 7/10/2000 Overburden	7MW5S FD0710001 DUP 7/10/2000	7MW6S S7MW06S01 NORMAL 7/11/2000 Overburden	7MW7S S7MW07S01 NORMAL 7/10/2000 Bedrock	7MW8S S7MW08S01 NORMAL 7/8/2000 Overburden	7MW9S S7MW09S01 NORMAL 7/11/2000 Overburden	7MW10S S7MW10S01 DUP 7/7/2000 Overburden
Volatile Organics (ug/L)									
1,3-DICHLOROBENZENE	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U
1,4-DICHLOROBENZENE	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U
TRICHLOROETHENE	1 U	7.58	1 U	1 U	1 U	2.03	1 U	23	1 U
Dissolved Gases (ug/L)									
METHANE	1 U	1 UJ	1 UJ	1 U	41 J	1 UJ	1 U	2 U	1 U
Semivolatile Organics (ug/L)									
BIS(2-ETHYLHEXYL)PHTHALATE	5 U	5 U	5 U	5 U	5 U	10 U	190	5 U	5 U
FLUORENE	0.05 U	0.1 U	0.26 J	0.1 U	0.1 U	0.1 U	6.5	0.1 U	0.05 U
HEXACHLOROBENZENE	5 U	5 U	5 U	5 U	5 U	10 U	5 UJ	3 J	5 U
PHENANTHRENE	0.03 U	0.05 U	0.05 U	0.05 U	0.05 U	0.05 U	3.7	0.05 U	0.03 U
Total Metals (ug/L)									
ALUMINUM	50.5 U	598	54.2 U	50.5 U	50.5 U	50.5 U	124	430 U	50.5 U
ARSENIC	2.3 U	2.3 U	2.3 U	2.3 U	2.3 U	2.3 U	2.3 U	2.9 J	2.3 U
BARIUM	34.1	55.1	11.7 U	11.4 U	39.4	16.5 U	8.6 U	37.8	33.6
CADMIUM	0.38 U	0.25 U	0.25 U	0.25 U	0.25 U	0.25 U	0.25 U	0.25 U	0.25 U
CALCIUM	28300	103000	6780	6770	18300	17700	13800	24900	20600
CHROMIUM	6.2 U	47	6.2 U	6.2 U	6.2 U	6.2 U	6.2 U	6.2 U	6.2 U
COBALT	4.2 U	4.2 U	7.1 J	5.3 J	5.3 J	4.4 J	4.2 U	8.9	4.2 U
COPPER	8 U	10.7 J	7.1 J	8.9 J	9.7 J	8.9 J	6.8 U	6.8 U	6.8 U
IRON	72.5 U	996	36.5 U	39.5 U	2330	45.1 U	2150 J	14600	37.3 U
LEAD	1.8 U	6.5	1.8 U	1.8 U	2.1 J	1.8 U	1.8 U	5.5	1.8 U
MAGNESIUM	6530 J	6950	882	871	4000	2410	1390 J	4010	6280 J
MANGANESE	4.6 J	96.6	2.7 U	2.7 U	428	10.7	64.3 J	1000	2.7 UJ
NICKEL	9.2 U	34.3	9.2 U	9.2 U	9.2 U	9.2 U	9.2 U	9.2 U	9.2 U
POTASSIUM	6090	6920	917	1080	5520	3070	2340	4880	3340
SELENIUM	2.8 U	2.8 U	2.8 U	2.8 U	2.8 U	3.2 J	2.8 U	2.8 U	2.8 U
SODIUM	76900	30000	5140	5100	41600	23200	17700	55100	43500
VANADIUM	6.3 U	6.3 U	6.3 U	6.3 U	6.3 U	6.3 U	6.3 U	7.6 J	6.3 U
ZINC	72.8 J	18.6	20.6	21.4	13.4	10.3	27.1 U	8.4 J	194 J

TABLE 2-6

SUMMARY OF GROUNDWATER ANALYTICAL RESULTS FOR PERMANENT WELLS AT SITE 7
SITES 3, 7, 14, 15, 18, AND 20 GROUNDWATER RECORD OF DECISION
NSB-NLON, GROTON, CONNECTICUT
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location sample sacode sample_dat Aquifer	7MW4S S7MW04S01 NORMAL 7/9/2000 Bedrock	7MW5D S7MW05D01 NORMAL 7/11/2000 Bedrock	7MW5S S7MW05S01 DUP 7/10/2000 Overburden	7MW5S FD0710001 DUP 7/10/2000	7MW6S S7MW06S01 NORMAL 7/11/2000 Overburden	7MW7S S7MW07S01 NORMAL 7/10/2000 Bedrock	7MW8S S7MW08S01 NORMAL 7/8/2000 Overburden	7MW9S S7MW09S01 NORMAL 7/11/2000 Overburden	7MW10S S7MW10S01 DUP 7/7/2000 Overburden
Dissolved Metals (ug/L)									
BARIUM									
CALCIUM									
COPPER									
MAGNESIUM									
MANGANESE									
POTASSIUM									
SODIUM									
ZINC									
Miscellaneous Parameters (mg/L)									
ALKALINITY	83.5 J	124	10 J	10 J	64	58 J	57.3 J	71.6	71.3 J
AMMONIA		0.15	0.18 J	0.17 J	0.44	0.48 J		0.26	
AMMONIA, AS NITROGEN	0.1 U						0.1		0.42 J
AMMONIUM	0.2 U	0.2 U	0.2 U	0.2 U	0.4	0.2 U	0.2	0.2 U	0.2 U
CHLORIDE	153 J	142	7.14	7	40.6	35.1	16.5 J	123	155 J
HARDNESS as CaCO ₃	97.4	285	20.5	20.5	62.2	54.1	40.2	78.7	77.4
SULFATE	50.2 J	62.5	13.8	13.8	43.5	22.2	3.46 J	30.2	71.6 J
TOTAL DISSOLVED SOLIDS	359 J	464	50 J	63.8 J	205	139 J	114 U	251	279 J
TOTAL ORGANIC CARBON	5 U	1.5	0.9	1.1	3.7	120	5 U	2.6	7
TOTAL SUSPENDED SOLIDS	5 UJ	108	5 UJ	5 UJ	5 U	5 UJ	5 UJ	17	5 UJ

TABLE 2-6

SUMMARY OF GROUNDWATER ANALYTICAL RESULTS FOR PERMANENT WELLS AT SITE 7
SITES 3, 7, 14, 15, 18, AND 20 GROUNDWATER RECORD OF DECISION
NSB-NLON, GROTON, CONNECTICUT
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location sample sacode sample_dat Aquifer	7MW10S FD0707001 DUP 7/7/2000 Overburden	7MW10S S7MW10S01-F DUP 7/7/2000	7MW10S FD0707001-F DUP 7/7/2000	7MW11S S7MW11S01 NORMAL 7/11/2000 Overburden
Volatile Organics (ug/L)				
1,3-DICHLOROBENZENE	1 U			1 U
1,4-DICHLOROBENZENE	1 U			1 U
TRICHLOROETHENE	1 U			1 U
Dissolved Gases (ug/L)				
METHANE	1 U			7 J
Semivolatile Organics (ug/L)				
BIS(2-ETHYLHEXYL)PHTHALATE	5 U			5 U
FLUORENE	0.05 U			0.1 U
HEXACHLOROBENZENE	5 U			5 U
PHENANTHRENE	0.03 U			0.05 U
Total Metals (ug/L)				
ALUMINUM	50.5 U			50.5 U
ARSENIC	2.3 U			2.3 U
BARIUM	35.7			40.5
CADMIUM	0.25 U			0.25 U
CALCIUM	22600			23500
CHROMIUM	6.2 U			6.2 U
COBALT	7.8 J			4.2 U
COPPER	7 U			6.8 U
IRON	31.1 U			298
LEAD	1.8 U			1.9 J
MAGNESIUM	6960 J			5300
MANGANESE	2.7 UJ			481
NICKEL	9.2 U			9.2 U
POTASSIUM	3630			6050
SELENIUM	2.8 U			2.8 U
SODIUM	47300			61000
VANADIUM	6.3 U			6.3 U
ZINC	72.8 J			4.6 U

TABLE 2-6

SUMMARY OF GROUNDWATER ANALYTICAL RESULTS FOR PERMANENT WELLS AT SITE 7
SITES 3, 7, 14, 15, 18, AND 20 GROUNDWATER RECORD OF DECISION
NSB-NLON, GROTON, CONNECTICUT
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location sample sacode sample_dat Aquifer	7MW10S FD0707001 DUP 7/7/2000 Overburden	7MW10S S7MW10S01-F DUP 7/7/2000	7MW10S FD0707001-F DUP 7/7/2000	7MW11S S7MW11S01 NORMAL 7/11/2000 Overburden
Dissolved Metals (ug/L)				
BARIUM		35.5	36.9	
CALCIUM		22200	23400	
COPPER		18	14	
MAGNESIUM		6890	7280	
MANGANESE		2.7 UJ	2.7 UJ	
POTASSIUM		3480	3520	
SODIUM		45900	47600	
ZINC		67.4	56.4	
Miscellaneous Parameters (mg/L)				
ALKALINITY	41.9 J			66
AMMONIA				0.26
AMMONIA, AS NITROGEN	0.25 J			
AMMONIUM	0.2 U			0.2 U
CHLORIDE	77.8 J			71.4
HARDNESS as CaCO3	85			80.5
SULFATE	44.7 J			40.3
TOTAL DISSOLVED SOLIDS	269 J			274
TOTAL ORGANIC CARBON	1 U			2.4
TOTAL SUSPENDED SOLIDS	5 UJ			5 U

Taken from Basewide Groundwater Operable Unit Remedial Investigation (TtNUS, 2002a).

TABLE 2-7

OCCURRENCE, DISTRIBUTION, AND SELECTION OF CHEMICALS OF POTENTIAL CONCERN IN GROUNDWATER AT SITE 7
DIRECT CONTACT EXPOSURE SCENARIOS
SITES 3, 7, 14, 15, 18, AND 20 GROUNDWATER RECORD OF DECISION
NSB-NLON, GROTON, CONNECTICUT
PAGE 1 OF 4

Scenario Timeframe: Future
Medium: Groundwater
Exposure Medium: Groundwater
Exposure Point: Torpedo Shops (Site 7)

CAS Number	Chemical	Minimum Concentration ⁽¹⁾	Minimum Qualifier	Maximum Concentration ⁽¹⁾	Maximum Qualifier	Units	Location of Maximum Concentration	Detection Frequency ⁽¹⁾	Range of Nondetects ⁽²⁾	Concentration Used for Screening ⁽³⁾	Background Value ⁽⁴⁾	Risk-Based COPC Screening Level ⁽⁵⁾	Potential ARAR/TBC Value	Potential ARAR/TBC Source	COPC Flag	Rationale for Contaminant Deletion or Selection ⁽⁶⁾
Volatile Organics																
541-73-1	1,3-DICHLOROBENZENE	1.73		1.73		ug/L	S7MW03S01	1/27	1	1.73	N/A	0.55 N	600 N/A N/A	CTDEP RSR FED-MCL CTDEP-MCL	YES	ASL
106-46-7	1,4-DICHLOROBENZENE	1.71		90.5	J	ug/L	S7TW1001	4/27	1	90.5	N/A	0.5 C	75 75 N/A	CTDEP RSR FED-MCL CTDEP-MCL	YES	ASL
71-43-2	BENZENE	2	J	2	J	ug/L	S7TW1001	2/27	1	2	N/A	0.35 C	1 5 5	CTDEP RSR FED-MCL CTDEP-MCL	YES	ASL
108-90-7	CHLOROBENZENE	6.66		165	J	ug/L	S7TW1001	2/27	1	165	N/A	11 N	100 100 100	CTDEP RSR FED-MCL CTDEP-MCL	YES	ASL
79-01-6	TRICHLOROETHENE	1.39		23		ug/L	S7MW09S01	7/27	1	23	N/A	1.6 C	5 5 5	CTDEP RSR FED-MCL CTDEP-MCL	YES	ASL
Dissolved Gases																
74-82-8	METHANE	1		41	J	ug/L	S7MW06S01	7/20	1 - 2	41	N/A	N/A	N/A N/A N/A	CTDEP RSR FED-MCL CTDEP-MCL	NO	NTX
Semivolatile Organics																
117-81-7	BIS(2-ETHYLHEXYL)PHthalate	44		190		ug/L	S7MW08S01	3/20	5 - 10	190	N/A	4.8 C	2 6 N/A	CTDEP RSR FED-MCL CTDEP-MCL	YES	ASL
86-73-7	FLUORENE	0.26	J	6.5		ug/L	S7MW08S01	1/20	0.05 - 5	6.5	N/A	24 N	280 N/A N/A	CTDEP RSR FED-MCL CTDEP-MCL	NO	BSL, BKG
118-74-1	HEXACHLOROBENZENE	3	J	3	J	ug/L	S7MW09S01	1/20	5 - 10	3	N/A	0.042 C	1 1 N/A	CTDEP RSR FED-MCL CTDEP-MCL	YES	ASL
85-01-8	PHENANTHRENE	3.7		3.7		ug/L	S7MW08S01	1/20	0.03 - 5	3.7	N/A	18 (7) N	200 N/A N/A	CTDEP RSR FED-MCL CTDEP-MCL	NO	BSL, BKG
Total Metals																
7429-90-5	ALUMINUM	72.4	J	57500		ug/L	S7TW0901	10/20	50.5 - 430	57500	3560	3600 N	N/A 50 to 200 N/A	CTDEP RSR FED-SMCL CTDEP-MCL	NO	EPAI
7440-38-2	ARSENIC	2.9	J	11.4		ug/L	S7TW0901	2/20	2.3	11.4	1.92	0.045 C	50 10 50	CTDEP RSR FED-MCL CTDEP-MCL	YES	ASL
7440-39-3	BARIUM	33.5		434		ug/L	S7TW0901	11/20	8.6 - 38.6	434	227	260 N	1000 2000 2000	CTDEP RSR FED-MCL CTDEP-MCL	YES	ASL
7440-43-9	CADMIUM	0.27	J	0.27	J	ug/L	S7MW03S01	1/20	0.25 - 0.38	0.27	ND	1.8 N	5 5 ⁽⁹⁾ 5	CTDEP RSR FED-MCL CTDEP-MCL	NO	BSL
7440-70-2	CALCIUM	5480		103000		ug/L	S7MW05D01	20/20	N/A	103000	188000	N/A	N/A N/A N/A	CTDEP RSR FED-MCL CTDEP-MCL	NO	NUT, BKG
7440-47-3	CHROMIUM	7.6	J	127		ug/L	S7TW0901	4/20	6.2 - 8.8	127	49.9	110 (8) N	50 100 N/A	CTDEP RSR FED-MCL CTDEP-MCL	YES	ASL
7440-48-4	COBALT	4.4	J	31.3		ug/L	S7TW0901	10/20	4.2 - 13.9	31.3	48.6	220 N	N/A N/A N/A	CTDEP RSR FED-MCL CTDEP-MCL	NO	BSL, BKG
7440-50-8	COPPER	7.1	J	73.2		ug/L	S7TW0901	7/20	6.8 - 11.6	73.2	107	140 N	1300 1300 N/A	CTDEP RSR FED-MCL CTDEP-MCL	NO	BSL, BKG

TABLE 2-7

OCCURRENCE, DISTRIBUTION, AND SELECTION OF CHEMICALS OF POTENTIAL CONCERN IN GROUNDWATER AT SITE 7
DIRECT CONTACT EXPOSURE SCENARIOS
SITES 3, 7, 14, 15, 18, AND 20 GROUNDWATER RECORD OF DECISION
NSB-NLON, GROTON, CONNECTICUT
PAGE 2 OF 4

Scenario Timeframe: Future
Medium: Groundwater
Exposure Medium: Groundwater
Exposure Point: Torpedo Shops (Site 7)

CAS Number	Chemical	Minimum Concentration (1)	Minimum Qualifier	Maximum Concentration (1)	Maximum Qualifier	Units	Location of Maximum Concentration	Detection Frequency (1)	Range of Nondetects ⁽²⁾	Concentration Used for Screening ⁽³⁾	Background Value ⁽⁴⁾	Risk-Based COPC Screening Level ⁽⁵⁾	Potential ARAR/TBC Value	Potential ARAR/TBC Source	COPC Flag	Rationale for Contaminant Deletion or Selection ⁽⁶⁾
7439-89-6	IRON	298		59400		ug/L	S7TW0901	10/20	31.1 - 759	59400	28200	1100 N	N/A 300 N/A	CTDEP RSR FED-SMCL CTDEP-MCL	NO	EPAI
7439-92-1	LEAD	1.9	J	32.8		ug/L	S7TW0901	8/20	1.8	32.8	6.63	N/A	15 15 N/A	CTDEP RSR FED-MCL CTDEP-MCL	YES	ASL
7439-95-4	MAGNESIUM	871		19500		ug/L	S7TW0901	20/20	N/A	19500	191000	N/A	N/A N/A N/A	CTDEP RSR FED-MCL CTDEP-MCL	NO	NUT, BKG
7439-96-5	MANGANESE	4.6	J	1250		ug/L	S7TW0901	17/20	2.7	1250	11700	88 N	N/A 50 N/A	CTDEP RSR FED-SMCL CTDEP-MCL	NO	BKG
7440-02-0	NICKEL	34.3		52.8	J	ug/L	S7TW0901	2/20	9.2	52.8	32.2	73 N	100 N/A 100	CTDEP RSR FED-MCL CTDEP-MCL	NO	BSL
7440-09-7	POTASSIUM	917		11600		ug/L	S7TW0901	20/20	N/A	11600	70800	N/A	N/A N/A N/A	CTDEP RSR FED-MCL CTDEP-MCL	NO	NUT, BKG
7782-49-2	SELENIUM	3.2	J	3.2	J	ug/L	S7MW07S01	1/20	2.8	3.2	3.19	18 N	50 50 50	CTDEP RSR FED-MCL CTDEP-MCL	NO	BSL
7440-22-4	SILVER	16.3		16.3		ug/L	S7TW0901	1/20	5.2 - 5.8	16.3	ND	18 N	36 100 50	CTDEP RSR FED-SMCL CTDEP-MCL	NO	BSL
7440-23-5	SODIUM	4020		91600		ug/L	S7MW03D01	20/20	N/A	91600	1900000	N/A	N/A N/A N/A	CTDEP RSR FED-MCL CTDEP-MCL	NO	NUT, BKG
7440-62-2	VANADIUM	7.6	J	151		ug/L	S7TW0901	2/20	6.3	151	10.2	26 N	50 N/A N/A	CTDEP RSR FED-MCL CTDEP-MCL	YES	ASL
7440-66-6	ZINC	8.4	J	194	J	ug/L	S7MW10S01	11/20	4.6 - 27.1	194	131	1100 N	5000 5000 N/A	CTDEP RSR FED-SMCL CTDEP-MCL	NO	BSL
Dissolved Metals																
7440-39-3	BARIUM, FILTERED	35.5		36.9		ug/L	S7MW10S01-F-D	1/2	18.7	36.9	124	260 N	1000 2000 2000	CTDEP RSR FED-MCL CTDEP-MCL	NO	BSL, BKG
7440-70-2	CALCIUM, FILTERED	17600		23400		ug/L	S7MW10S01-F-D	2/2	N/A	23400	152000	N/A	N/A N/A N/A	CTDEP RSR FED-MCL CTDEP-MCL	NO	NUT, BKG
7440-50-8	COPPER, FILTERED	14		18		ug/L	S7MW10S01-F	1/2	6.8	18	39.4	140 N	1300 1300 N/A	CTDEP RSR FED-MCL CTDEP-MCL	NO	BSL, BKG
7439-95-4	MAGNESIUM, FILTERED	1470		7280		ug/L	S7MW10S01-F-D	2/2	N/A	7280	150000	N/A	N/A N/A N/A	CTDEP RSR FED-MCL CTDEP-MCL	NO	NUT, BKG
7439-96-5	MANGANESE, FILTERED	7.8	J	7.8	J	ug/L	S7MW01D01-F	1/2	2.7	7.8	9400	88 N	N/A 50 N/A	CTDEP RSR FED-MCL CTDEP-MCL	NO	BSL, BKG
7440-09-7	POTASSIUM, FILTERED	1730		3520		ug/L	S7MW10S01-F-D	2/2	N/A	3520	60000	N/A	N/A N/A N/A	CTDEP RSR FED-MCL CTDEP-MCL	NO	NUT, BKG
7440-23-5	SODIUM, FILTERED	4690		47600		ug/L	S7MW10S01-F-D	2/2	N/A	47600	1580000	N/A	N/A N/A N/A	CTDEP RSR FED-MCL CTDEP-MCL	NO	NUT, BKG
7440-66-6	ZINC, FILTERED	56.4		173		ug/L	S7MW01D01-F	2/2	N/A	173	109	1100 N	5000 5000 N/A	CTDEP RSR FED-MCL CTDEP-MCL	NO	BSL

TABLE 2-7

OCCURRENCE, DISTRIBUTION, AND SELECTION OF CHEMICALS OF POTENTIAL CONCERN IN GROUNDWATER AT SITE 7
DIRECT CONTACT EXPOSURE SCENARIOS
SITES 3, 7, 14, 15, 18, AND 20 GROUNDWATER RECORD OF DECISION
NSB-NLON, GROTON, CONNECTICUT
PAGE 3 OF 4

Scenario Timeframe: Future
Medium: Groundwater
Exposure Medium: Groundwater
Exposure Point: Torpedo Shops (Site 7)

CAS Number	Chemical	Minimum Concentration ⁽¹⁾	Minimum Qualifier	Maximum Concentration ⁽¹⁾	Maximum Qualifier	Units	Location of Maximum Concentration	Detection Frequency ⁽¹⁾	Range of Nondetects ⁽²⁾	Concentration Used for Screening ⁽³⁾	Background Value ⁽⁴⁾	Risk-Based COPC Screening Level ⁽⁵⁾	Potential ARAR/TBC Value	Potential ARAR/TBC Source	COPC Flag	Rationale for Contaminant Deletion or Selection ⁽⁶⁾
Miscellaneous Parameters																
E-14506	ALKALINITY	10	J	124		mg/L	S7MW05D01	20/20	N/A	124	1950	N/A	N/A N/A N/A	CTDEP RSR FED-MCL CTDEP-MCL	NO	BKG
7664-41-7	AMMONIA	0.15		0.48	J	mg/L	S7MW07S01	8/8	N/A	0.48	ND	N/A	N/A N/A N/A	CTDEP RSR FED-MCL CTDEP-MCL	NO	NTX
7664-41-7	AMMONIA, AS NITROGEN	0.1		0.54	J	mg/L	S7MW01D01	10/12	N/A	0.54	ND	N/A	N/A N/A N/A	CTDEP RSR FED-MCL CTDEP-MCL	NO	NTX
7664-41-7	AMMONIUM	0.2		0.44		mg/L	S7TW0801	6/20	N/A	0.44	ND	N/A	N/A N/A N/A	CTDEP RSR FED-MCL CTDEP-MCL	NO	NTX
000-02-0	CHLORIDE	5.84	J	155	J	mg/L	S7MW10S01	20/20	N/A	155	4540	N/A	N/A 250 N/A	CTDEP RSR FED-SMCL CTDEP-MCL	NO	BSL, BKG
E-11778	HARDNESS as CaCO ₃	18.8		285		mg/L	S7MW05D01	20/20	N/A	285	ND	N/A	N/A N/A N/A	CTDEP RSR FED-MCL CTDEP-MCL	NO	NTX
14808-79-8	SULFATE	3.46	J	71.6	J	mg/L	S7MW10S01	20/20	N/A	71.6	45.2	N/A	N/A 250 N/A	CTDEP RSR FED-SMCL CTDEP-MCL	NO	BSL
18496-25-8	SULFIDE	0.07		0.07		mg/L	S7TW1001	1/12	0.05 - 2	0.07	ND	N/A	N/A N/A N/A	CTDEP RSR FED-MCL CTDEP-MCL	NO	NTX
000-09-0	TOTAL DISSOLVED SOLIDS	50	J	464		mg/L	S7MW05D01	15/20	66.2 - 158	464	6260	N/A	N/A 500 N/A	CTDEP RSR FED-SMCL CTDEP-MCL	NO	BSL, BKG
7440-44-0	TOTAL ORGANIC CARBON	0.9		120		mg/L	S7MW07S01	15/20	1 - 5	120	37.7	N/A	N/A N/A N/A	CTDEP RSR FED-MCL CTDEP-MCL	NO	NTX
000-08-9	TOTAL SUSPENDED SOLIDS	10	J	2950		mg/L	S7TW0901	8/20	5	2950	236	N/A	N/A N/A N/A	CTDEP RSR FED-MCL CTDEP-MCL	NO	NTX

Taken from Basewide Groundwater Operable Unit Remedial Investigation Update/Feasibility Study Report (TINUS, 2004) includes data from Basewide Groundwater Operable Unit Remedial Investigation Report (TINUS, 2002a) and updated screening criteria.

A shaded value indicates that the concentration used for screening exceeds the criterion or background value.

A shaded chemical name indicates that the chemical has been selected as a COPC.

Footnotes:

- Sample and duplicate are counted as two separate samples when determining the minimum and maximum detected concentrations.
- Values presented are sample-specific quantitation limits.
- The maximum detected concentration is used for screening purposes.
- 95% Upper Tolerance Limit (UTL) of site background data.
- The risk-based COPC screening level for tap water use is presented. The value is based on a target hazard quotient of 0.1 for noncarcinogens (denoted with a "N" flag) or an incremental cancer risk of 1E-6 for carcinogens (denoted with a "C" flag) (EPA, 2000b).
- The chemical is selected as a COPC if the maximum detected concentration exceeds the risk-based COPC screening level and/or an ARAR/TBC(s).
- Pyrene is used as a surrogate for phenanthrene.
- Value is for hexavalent chromium.
- The EPA has approved a new MCL for arsenic of 10 ug/L. The new MCL goes into effect in 2006. The reduction of the MCL does not impact the human health risk assessment.

Definitions:

ARAR/TBC = Applicable or Relevant and Appropriate Requirement/To Be Considered.

C = Carcinogen.

COPC = Chemical of Potential Concern.

J = Estimated Value.

N = Noncarcinogen.

N/A = Not Applicable.

FED-MCL = Federal Maximum Contaminant Level (EPA, 2000a).

FED-SMCL = Federal Secondary Maximum Contaminant Level (EPA, 2000a).

FED-AL = Federal Action Level (EPA, 2000a).

CTDEP-RSR = CTDEP RSRs, 1996.

CTDEP-MCL = Connecticut Maximum Contaminant Level.

Rationale Codes:

For Selection as a COPC:

ASL = Above COPC screening level/ARAR/TBC.

OCCURRENCE, DISTRIBUTION, AND SELECTION OF CHEMICALS OF POTENTIAL CONCERN IN GROUNDWATER AT SITE 7
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SITES 3, 7, 14, 15, 18, AND 20 GROUNDWATER RECORD OF DECISION
NSB-NLON, GROTON, CONNECTICUT
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[illegible]

For Elimination as a COPC:

- BKG = Less than Background Levels.
- BSL = Below COPC Screening Level/ARAR/TBC.
- NUT = Essential Nutrient.
- NTX = No Toxicity Information.
- EPAI = USEPA Region 1 does not advocate evaluation of this chemical.

TABLE 2-8

OCCURRENCE, DISTRIBUTION, AND SELECTION OF CHEMICALS OF POTENTIAL CONCERN IN GROUNDWATER AT SITE 7
MIGRATION PATHWAYS
SITES 3, 7, 14, 15, 18, AND 20 GROUNDWATER RECORD OF DECISION
NSB-NLON, GROTON, CONNECTICUT
PAGE 1 OF 2

Scenario Timeframe: Future
Medium: Groundwater
Exposure Medium: Groundwater
Exposure Point: Torpedo Shops (Site 7)

CAS Number	Chemical	Minimum Concentration ⁽¹⁾	Minimum Qualifier	Maximum Concentration ⁽¹⁾	Maximum Qualifier	Units	Location of Maximum Concentration	Detection Frequency ⁽¹⁾	Range of Nondetects ⁽²⁾	Concentration Used for Screening ⁽³⁾	Background Value ⁽⁴⁾	Surface Water Protection Criteria ⁽⁵⁾	Volatilization Criteria ⁽⁶⁾	COPC Flag	Rationale for Contaminant Deletion or Selection ⁽⁷⁾
Volatile Organics															
541-73-1	1,3-DICHLOROBENZENE	1.73		1.73		ug/L	S7MW03S01	1/27	1 - 5	1.73	N/A	26000	24200	NO	BSL
106-46-7	1,4-DICHLOROBENZENE	1.71		90.5	J	ug/L	S7TW1001	4/27	1	90.5	N/A	26000	50000	NO	BSL
71-43-2	BENZENE	2	J	2	J	ug/L	S7TW1001	2/27	1	2	N/A	710	215	NO	BSL
108-90-7	CHLOROBENZENE	6.66		165	J	ug/L	S7TW1001	2/27	1	165	N/A	420000	1800	NO	BSL
79-01-6	TRICHLOROETHENE	1.39		23		ug/L	S7MW09S01	7/27	1	23	N/A	2340	219	NO	BSL
Dissolved Gases															
74-82-8	METHANE	1		41	J	ug/L	S7MW06S01	7/20	1 - 2	41	N/A	N/A	N/A	NO	NTX
Semivolatile Organics															
117-81-7	BIS(2-ETHYLHEXYL)PHTHALATE	44		190		ug/L	S7MW08S01	3/20	5 - 10	190	N/A	59	N/A	YES	ASL
86-73-7	FLUORENE	0.26	J	6.5		ug/L	S7MW08S01	2/20	0.05 - 5	6.5	N/A	140000	N/A	NO	BSL
118-74-1	HEXACHLOROBENZENE	3	J	3	J	ug/L	S7MW09S01	1/20	5 - 10	3	N/A	0.077	N/A	YES	ASL
85-01-8	PHENANTHRENE	3.7		3.7		ug/L	S7MW08S01	1/20	0.03 - 5	3.7	N/A	0.3	N/A	YES	ASL
Total Metals															
7429-90-5	ALUMINUM	72.4	J	57500		ug/L	S7TW0901	10/20	50.5 - 430	57500	3560	N/A	N/A	NO	NTX
7440-38-2	ARSENIC	2.9	J	11.4		ug/L	S7TW0901	2/20	2.3	11.4	1.92	4	N/A	YES	ASL
7440-39-3	BARIUM	33.5		434		ug/L	S7TW0901	11/20	8.6 - 38.6	434	227	N/A	N/A	NO	NTX
7440-43-9	CADMIUM	0.27	J	0.27	J	ug/L	S7MW03S01	1/20	0.25 - 0.38	0.27	ND	6	N/A	NO	BSL
7440-70-2	CALCIUM	5480		103000		ug/L	S7MW05D01	20/20	N/A	103000	188000	N/A	N/A	NO	BKG
7440-47-3	CHROMIUM	7.6	J	127		ug/L	S7TW0901	4/20	6.2 - 8.8	127	49.9	N/A	N/A	NO	NTX
7440-48-4	COBALT	4.4	J	31.3		ug/L	S7TW0901	10/20	4.2 - 13.9	31.3	48.6	N/A	N/A	NO	BKG
7440-50-8	COPPER	7.1	J	73.2		ug/L	S7TW0901	7/20	6.8 - 11.6	73.2	107	48	N/A	NO	BKG
7439-89-6	IRON	298		59400		ug/L	S7TW0901	10/20	31.1 - 759	59400	28200	N/A	N/A	NO	NTX
7439-92-1	LEAD	1.9	J	32.8		ug/L	S7TW0901	8/20	1.8	32.8	6.63	13	N/A	YES	ASL
7439-95-4	MAGNESIUM	871		19500		ug/L	S7TW0901	20/20	N/A	19500	191000	N/A	N/A	NO	BKG
7439-96-5	MANGANESE	4.6	J	1250		ug/L	S7TW0901	17/20	2.7	1250	11700	N/A	N/A	NO	BKG
7440-02-0	NICKEL	34.3		52.8	J	ug/L	S7TW0901	2/20	9.2	52.8	32.2	880	N/A	NO	BSL
7440-09-7	POTASSIUM	917		11600		ug/L	S7TW0901	20/20	N/A	11600	70800	N/A	N/A	NO	BKG
7782-49-2	SELENIUM	3.2	J	3.2	J	ug/L	S7MW07S01	1/20	2.8	3.2	3.19	50	N/A	NO	BSL
7440-22-4	SILVER	16.3		16.3		ug/L	S7TW0901	1/20	5.2 - 5.8	16.3	ND	12	N/A	YES	ASL
7440-23-5	SODIUM	4020		91600		ug/L	S7MW03D01	20/20	N/A	91600	1900000	N/A	N/A	NO	BKG
7440-62-2	VANADIUM	7.6	J	151		ug/L	S7TW0901	2/20	6.3	151	10.2	N/A	N/A	NO	NTX
7440-66-6	ZINC	8.4	J	194	J	ug/L	S7MW10S01	11/20	4.6 - 27.1	194	131	123	N/A	YES	ASL
Dissolved Metals															
7440-39-3	BARIUM, FILTERED	35.5		36.9		ug/L	S7MW10S01-F-D	1/2	18.7	36.9	124	N/A	N/A	NO	BKG
7440-70-2	CALCIUM, FILTERED	17600		23400		ug/L	S7MW10S01-F-D	2/2	N/A	23400	152000	N/A	N/A	NO	BKG
7440-50-8	COPPER, FILTERED	14		18		ug/L	S7MW10S01-F	1/2	6.8	18	39.4	48	N/A	NO	BSL, BKG
7439-95-4	MAGNESIUM, FILTERED	1470		7280		ug/L	S7MW10S01-F-D	2/2	N/A	7280	150000	N/A	N/A	NO	BKG
7439-96-5	MANGANESE, FILTERED	7.8	J	7.8	J	ug/L	S7MW01D01-F	1/2	2.7	7.8	9400	N/A	N/A	NO	BKG
7440-09-7	POTASSIUM, FILTERED	1730		3520		ug/L	S7MW10S01-F-D	2/2	N/A	3520	60000	N/A	N/A	NO	BKG
7440-23-5	SODIUM, FILTERED	4690		47600		ug/L	S7MW10S01-F-D	2/2	N/A	47600	1580000	N/A	N/A	NO	BKG
7440-66-6	ZINC, FILTERED	56.4		173		ug/L	S7MW01D01-F	2/2	N/A	173	109	123	N/A	YES	ASL
Miscellaneous Parameters															
E-14506	ALKALINITY	10	J	124		mg/L	S7MW05D01	20/20	N/A	124	1950	N/A	NA	NO	BKG
7664-41-7	AMMONIA	0.15		0.48	J	mg/L	S7MW07S01	8/8	N/A	0.48	ND	N/A	NA	NO	NTX
7664-41-7	AMMONIA, AS NITROGEN	0.1		0.54	J	mg/L	S7MW01D01	10/12	N/A	0.54	ND	N/A	NA	NO	NTX
7664-41-7	AMMONIUM	0.2		0.44		mg/L	S7TW0801	6/20	N/A	0.44	ND	N/A	NA	NO	NTX
000-02-0	CHLORIDE	5.84	J	155	J	mg/L	S7MW10S01	20/20	N/A	155	4540	N/A	NA	NO	BKG
E-11778	HARDNESS as CaCO3	18.8		285		mg/L	S7MW05D01	20/20	N/A	285	ND	N/A	NA	NO	NTX
14808-79-8	SULFATE	3.46	J	71.6	J	mg/L	S7MW10S01	20/20	N/A	71.6	45.2	N/A	NA	NO	NTX
18496-25-8	SULFIDE	0.07		0.07		mg/L	S7TW1001	1/12	0.05 - 2	0.07	ND	N/A	NA	NO	NTX

TABLE 2-8

OCCURRENCE, DISTRIBUTION, AND SELECTION OF CHEMICALS OF POTENTIAL CONCERN IN GROUNDWATER AT SITE 7
MIGRATION PATHWAYS
SITES 3, 7, 14, 15, 18, AND 20 GROUNDWATER RECORD OF DECISION
NSB-NLON, GROTON, CONNECTICUT
PAGE 2 OF 2

Scenario Timeframe: Future
Medium: Groundwater
Exposure Medium: Groundwater
Exposure Point: Torpedo Shops (Site 7)

CAS Number	Chemical	Minimum Concentration ⁽¹⁾	Minimum Qualifier	Maximum Concentration ⁽¹⁾	Maximum Qualifier	Units	Location of Maximum Concentration	Detection Frequency ⁽¹⁾	Range of Nondetects ⁽²⁾	Concentration Used for Screening ⁽³⁾	Background Value ⁽⁴⁾	Surface Water Protection Criteria ⁽⁵⁾	Volatilization Criteria ⁽⁶⁾	COPC Flag	Rationale for Contaminant Deletion or Selection ⁽⁷⁾
000-09-0	TOTAL DISSOLVED SOLIDS	50	J	464		mg/L	S7MW05D01	15/20	66.2 - 158	464	6260	N/A	NA	NO	BKG
7440-44-0	TOTAL ORGANIC CARBON	0.9		120		mg/L	S7MW07S01	15/20	1 - 5	120	37.7	N/A	NA	NO	NTX
000-08-9	TOTAL SUSPENDED SOLIDS	10	J	2950		mg/L	S7TW0901	8/20	5	2950	236	N/A	NA	NO	NTX

Taken from Basewide Groundwater Operable Unit Remedial Investigation Update/Feasibility Study Report (TtNUS, 2004) includes data from Basewide Groundwater Operable Unit Remedial Investigation Report (TtNUS, 2002a) and updated screening criteria.

A shaded value indicates that the concentration used for screening exceeds the criterion or background value.

A shaded chemical name indicates that the chemical has been selected as a COPC.

Footnotes:

- Sample and duplicate are counted as two separate samples when determining the minimum and maximum detected concentrations.
- Values presented are sample-specific quantitation limits.
- The maximum detected concentration is used for screening purposes.
- 95% Upper Tolerance Limit (UTL) of site background data.
- Connecticut DEP Surface Water Protection criteria.
- Connecticut DEP Volatilization criteria for residential exposures.
- The chemical is selected as a COPC if the maximum detected concentration exceeds the CTDEP surface water protection or volatilization criteria.

Associated Samples:

S7B325MW0101 S7MW10S01
S7B325MW0301 S7MW10S01-AVG
S7B325MW0401 S7MW10S01-D
S7MW01D01 S7MW10S01-F
S7MW01D01-F S7MW10S01-F-AVG
S7MW02D01 S7MW10S01-F-D
S7MW02S01 S7MW11S01
S7MW03D01 S7TW0101
S7MW03S01 S7TW0201
S7MW04S01 S7TW0301
S7MW05D01 S7TW0401
S7MW05S01 S7TW0501
S7MW05S01-AVG S7TW0601
S7MW05S01-D S7TW0701
S7MW06S01 S7TW0701-AVG
S7MW07S01 S7TW0701-D
S7MW08S01 S7TW0801
S7MW09S01 S7TW0901
S7TW1001

Definitions:

ARAR/TBC = Applicable or Relevant and Appropriate Requirement/To Be Considered.

C = Carcinogen.

COPC = Chemical of Potential Concern.

J = Estimated Value.

N = Noncarcinogen.

NA = Not Applicable.

Rationale Codes:

For Selection as a COPC:

ASL = Above COPC Screening Level/ARAR/TBC.

For Elimination as a COPC:

BKG = Less than Background Levels.

BSL = Below COPC Screening Level/ARAR/TBC.

NTX = No Toxicity Information.

TABLE 2-9

SUMMARY OF POSITIVE GROUNDWATER ANALYTICAL RESULTS FOR SITE 15
SITES 3, 7, 14, 15, 18, AND 20 GROUNDWATER RECORD OF DECISION
NSB-NLON, GROTON, CONNECTICUT
PAGE 1 OF 3

location	15MW1S	15MW1S	15MW2S	15MW2S	15MW2S	15MW2S
nsample	S15GW15MW1S02	S15GW15MW1S02-F	S15GW15MW2S02	S15GW15MW2S02-AVG	S15GW15MW2S02-D	S15GW15MW2S02-F
sample	S15GW15MW1S02	S15GW15MW1S02-F	S15GW15MW2S02	S15GW15MW2S02	FD10140201	S15GW15MW2S02-F
sample_dat	10/14/2002	10/14/2002	10/14/2002	10/14/2002	10/14/2002	10/14/2002
Volatile Organics (ug/L)						
CHLOROFORM	1 U		1 U	1 U	1 U	
Inorganics (ug/L)						
ALUMINUM	37.4 U		2780	2800	2820	
BARIUM	85.1		50.8	51.75	52.7	
BERYLLIUM	0.37 U		1.1 U	1.1 U	1.1 U	
CADMIUM	4.5 U		5.0 U	4.85 U	4.7 U	
CALCIUM	26400		11900	12000	12100	
CHROMIUM	0.87 J		0.55 U	0.55 U	0.55 U	
COBALT	5.1 U		8.4 J	8.1 J	7.8 J	
COPPER	3.4 U		19.2	20.25	21.3	
IRON	24.5 U		32.7 U	34.75 U	36.8 U	
LEAD	1.3 U		1.3 U	1.3 U	1.3 U	
MAGNESIUM	2980		2000	2025	2050	
MANGANESE	4.8		223	225	227	
POTASSIUM	4630		1540	1570	1600	
SODIUM	36200		35400	35800	36200	
ZINC	2.9 J		356	360.5	365	
Filtered Inorganics (ug/L)						
ALUMINUM		25.4 U				35.4 U
BARIUM		83.6				12.5
BERYLLIUM		0.37 U				0.37 U
CADMIUM		3.2 U				2.7 U
CALCIUM		25800				5490
CHROMIUM		0.75 J				0.55 U
COBALT		5.1 U				5.1 U
COPPER		3.4 U				3.4 U
IRON		12.0 U				2030 J
LEAD		1.3 U				1.3 U
MAGNESIUM		2930				1120
MANGANESE		4.2 J				311 J
POTASSIUM		4570				1420
SODIUM		35500 J				14600 J
ZINC		3.2 J				50.5 J

TABLE 2-9

**SUMMARY OF POSITIVE GROUNDWATER ANALYTICAL RESULTS FOR SITE 15
SITES 3, 7, 14, 15, 18, AND 20 GROUNDWATER RECORD OF DECISION
NSB-NLON, GROTON, CONNECTICUT
PAGE 2 OF 3**

location	15MW2S	15MW2S	15MW3S	15MW3S	15TW01	15TW01	15TW02
nsample	S15GW15MW2S02-F-AVG	S15GW15MW2S02-F-D	S15GW15MW3S02	S15GW15MW3S02-F	S15GW15TW101	S15GW15TW101-F	S15GW15TW201
sample	S15GW15MW2S02-F	FD10140201-F	S15GW15MW3S02	S15GW15MW3S02-F	S15GW15TW101	S15GW15TW101-F	S15GW15TW201
sample_dat	10/14/2002	10/14/2002	10/14/2002	10/14/2002	10/24/2002	10/24/2002	10/24/2002
Volatile Organics (ug/L)							
CHLOROFORM			1 U		1 U		1 U
Inorganics (ug/L)							
ALUMINUM			58.7 U		2240 J		78.8 U
BARIUM			31.4		50.2		78.2
BERYLLIUM			0.37 U		0.84		0.37 U
CADMIUM			2.5 U		2.5 U		4.4
CALCIUM			18800		8290		16000
CHROMIUM			0.55 U		1.1 U		0.55 U
COBALT			5.1 U		9.5		5.1 U
COPPER			3.4 U		13.9		3.4 U
IRON			7800		427		80.4 U
LEAD			1.3 U		2.3		1.3 U
MAGNESIUM			3780		1210		2200
MANGANESE			287		340		41.1
POTASSIUM			4390		1780		2120
SODIUM			42600		22600		45400
ZINC			1.6 U		181		60.9
Filtered Inorganics (ug/L)							
ALUMINUM	1393.85 J	2770 J		25.4 U		2160	
BARIUM	32.35	52.2		34.6		50.7	
BERYLLIUM	0.785 U	1.2 U		0.37 U		0.84	
CADMIUM	4.5 U	6.3 U		2.5 U		2.5 U	
CALCIUM	8745	12000		19800		8350	
CHROMIUM	0.55 U	0.55 U		0.56 J		0.80 U	
COBALT	4.675 J	6.8 J		5.1 U		7.5	
COPPER	9.95	18.2		3.4 U		15.2	
IRON	1016.65 J	6.6 U		6740 J		366	
LEAD	0.975 J	1.3 J		1.3 U		1.3 U	
MAGNESIUM	1570	2020		3870		1200	
MANGANESE	268.5 J	226 J		279 J		350	
POTASSIUM	1650	1880		4900		1760	
SODIUM	25000 J	35400 J		43600 J		23200	
ZINC	206.25 J	362 J		1.6 U		179	

TABLE 2-9

**SUMMARY OF POSITIVE GROUNDWATER ANALYTICAL RESULTS FOR SITE 15
SITES 3, 7, 14, 15, 18, AND 20 GROUNDWATER RECORD OF DECISION
NSB-NLON, GROTON, CONNECTICUT
PAGE 3 OF 3**

location	15TW02	15TW03	15TW03
nsample	S15GW15TW201-F	S15GW15TW301	S15GW15TW301-F
sample	S15GW15TW201-F	S15GW15TW301	S15GW15TW301-F
sample_dat	10/24/2002	10/24/2002	10/24/2002
Volatile Organics (ug/L)			
CHLOROFORM		3	
Inorganics (ug/L)			
ALUMINUM		137 U	
BARIUM		47.7	
BERYLLIUM		0.37 U	
CADMIUM		2.5 U	
CALCIUM		34200	
CHROMIUM		0.60 U	
COBALT		7.3	
COPPER		3.4 U	
IRON		215	
LEAD		1.8	
MAGNESIUM		3080	
MANGANESE		702	
POTASSIUM		5700	
SODIUM		38300	
ZINC		2.8 U	
Filtered Inorganics (ug/L)			
ALUMINUM	66.1 U		25.4 U
BARIUM	77.5		47.8
BERYLLIUM	0.37 U		0.37 U
CADMIUM	6.4		2.5 U
CALCIUM	16000		34700
CHROMIUM	0.55 U		0.55 U
COBALT	5.1 U		5.1 U
COPPER	3.4 U		3.4 U
IRON	75.7 U		135
LEAD	1.3 U		1.4
MAGNESIUM	2180		3080
MANGANESE	40.1		703
POTASSIUM	2050		5550
SODIUM	44900		38100
ZINC	60.4		2.3 U

From Basewide Groundwater Operable Unit Remedial
Investigation Update/Feasibility Study (TtNUS, 2004).

TABLE 2-10

OCCURRENCE, DISTRIBUTION, AND SELECTION OF COPCs IN GROUNDWATER AT SITE 15
DIRECT CONTACT EXPOSURE SCENARIOS
SITES 3, 7, 14, 15, 18, AND 20 GROUNDWATER RECORD OF DECISION
NSB-NLON, GROTON, CONNECTICUT
PAGE 1 OF 3

Scenario Timeframe: Future
Medium: Groundwater
Exposure Medium: Groundwater
Exposure Point: Site 15

CAS Number	Chemical	Minimum Concentration ⁽¹⁾	Minimum Qualifier	Maximum Concentration ⁽¹⁾	Maximum Qualifier	Units	Location of Maximum Concentration	Detection Frequency	Range of Nondetects ⁽²⁾	Concentration Used for Screening ⁽³⁾	Background Value ⁽⁴⁾	Risk-Based COPC Screening Level ⁽⁵⁾	Potential ARAR/TBC Value	Potential ARAR/TBC Source	COPC Flag ⁽⁶⁾	Rationale for Contaminant Deletion or Selection
Volatile Organic Compounds																
67-66-3	Chloroform	3		3		UG/L	S15GW15TW301	1/6	1	3	N/A	6.2 C	6 80 100	CTDEP RSR FED-MCL CTDEP-MCL	NO	BSL
Total Metals																
7429-90-5	Aluminum	2240	J	2820		UG/L	S15GW15MW2S02-D	2/6	37.4 - 137	2820	3560	3600 N	N/A 50 to 200 N/A	CTDEP RSR FED-SMCL CTDEP-MCL	NO	BKG, EPAI
7440-39-3	Barium	31.4		85.1		UG/L	S15GW15MW1S02	6/6	NA	85.1	227	260 N	1000 2000 2000	CTDEP RSR FED-MCL CTDEP-MCL	NO	BSL, BKG
7440-41-7	Beryllium	0.84		0.84		UG/L	S15GW15TW101	1/6	0.37 - 1.1	0.84	N/A	7.3 N	4 4 4	CTDEP RSR FED-MCL CTDEP-MCL	NO	BSL
7440-43-9	Cadmium	4.4		4.4		UG/L	S15GW15TW201	1/6	2.5 - 5	4.4	N/A	1.8 N	5 5 5	CTDEP RSR FED-MCL CTDEP-MCL	YES	ASL
7440-70-2	Calcium	8290		34200		UG/L	S15GW15TW301	6/6	NA	34200	188000	N/A	N/A N/A N/A	CTDEP RSR FED-MCL CTDEP-MCL	NO	NUT, BKG
7440-47-3	Chromium ⁽⁷⁾	0.87	J	0.87	J	UG/L	S15GW15MW1S02	1/6	0.55 - 1.1	0.87	49.9	11 N	N/A 100 N/A	CTDEP RSR FED-MCL CTDEP-MCL	NO	BSL, BKG
7440-48-4	Cobalt	7.3		9.5		UG/L	S15GW15TW101	3/6	5.1	9.5	48.6	73 N	N/A N/A N/A	CTDEP RSR FED-MCL CTDEP-MCL	NO	BSL, BKG
7440-50-8	Copper	13.9		21.3		UG/L	S15GW15MW2S02-D	2/6	3.4	21.3	107	150 N	1300 1300 N/A	CTDEP RSR FED-MCL CTDEP-MCL	NO	BSL, BKG
7439-89-6	Iron	215		7800		UG/L	S15GW15MW3S02	3/6	24.5 - 80.4	7800	28200	1100 N	N/A 300 N/A	CTDEP RSR FED-SMCL CTDEP-MCL	NO	BKG, EPAI
7439-92-1	Lead	1.8		2.3		UG/L	S15GW15TW101	2/6	1.3	2.3	6.63	N/A	15 15 N/A	CTDEP RSR FED-AL CTDEP-MCL	NO	BSL, BKG
7439-95-4	Magnesium	1210		3780		UG/L	S15GW15MW3S02	6/6	NA	3780	191000	N/A	N/A N/A N/A	CTDEP RSR FED-MCL CTDEP-MCL	NO	NUT, BKG
7439-96-5	Manganese	4.8		702		UG/L	S15GW15TW301	6/6	NA	702	11700	88 N	N/A 50 N/A	CTDEP RSR FED-SMCL CTDEP-MCL	NO	BKG
7440-09-7	Potassium	1540		5700		UG/L	S15GW15TW301	6/6	NA	5700	70800	N/A	N/A N/A N/A	CTDEP RSR FED-MCL CTDEP-MCL	NO	NUT, BKG
7440-23-5	Sodium	22600		45400		UG/L	S15GW15TW201	6/6	NA	45400	1900000	N/A	N/A N/A N/A	CTDEP RSR FED-MCL CTDEP-MCL	NO	NUT, BKG
7440-66-6	Zinc	2.9	J	365		UG/L	S15GW15MW2S02-D	4/6	1.6 - 2.8	365	131	1100 N	5000 5000 NA	CTDEP RSR FED-SMCL CTDEP-MCL	NO	BSL

TABLE 2-10

OCCURRENCE, DISTRIBUTION, AND SELECTION OF COPCs IN GROUNDWATER AT SITE 15
DIRECT CONTACT EXPOSURE SCENARIOS
SITES 3, 7, 14, 15, 18, AND 20 GROUNDWATER RECORD OF DECISION
NSB-NLON, GROTON, CONNECTICUT
PAGE 2 OF 3

Scenario Timeframe: Future
Medium: Groundwater
Exposure Medium: Groundwater
Exposure Point: Site 15

CAS Number	Chemical	Minimum Concentration ⁽¹⁾	Minimum Qualifier	Maximum Concentration ⁽¹⁾	Maximum Qualifier	Units	Location of Maximum Concentration	Detection Frequency	Range of Nondetects ⁽²⁾	Concentration Used for Screening ⁽³⁾	Background Value ⁽⁴⁾	Risk-Based COPC Screening Level ⁽⁵⁾	Potential ARAR/TBC Value	Potential ARAR/TBC Source	COPC Flag ⁽⁶⁾	Rationale for Contaminant Deletion or Selection
Filtered Metals																
7429-90-5	Aluminum-Filtered	2160		2770	J	UG/L	S15GW15MW2S02-F-D	2/6	25.4 - 66.1	2770	64.4	3600 N	N/A 50 to 200 N/A	CTDEP RSR FED-SMCL CTDEP-MCL	NO	EPAI
7440-39-3	Barium-Filtered	12.5		83.6		UG/L	S15GW15MW1S02-F	6/6	NA	83.6	124	260 N	1000 2000 2000	CTDEP RSR FED-MCL CTDEP-MCL	NO	BSL, BKG
7440-41-7	Beryllium-Filtered	0.84		0.84		UG/L	S15GW15TW101-F	1/6	0.37 - 1.2	0.84	N/A	7.3 N	4 4 4	CTDEP RSR FED-MCL CTDEP-MCL	NO	BSL
7440-43-9	Cadmium-Filtered	6.4		6.4		UG/L	S15GW15TW201-F	1/6	2.5 - 6.3	6.4	N/A	1.8 N	5 5 5	CTDEP RSR FED-MCL CTDEP-MCL	YES	ASL
7440-70-2	Calcium-Filtered	5490		34700		UG/L	S15GW15TW301-F	6/6	NA	34700	152000	N/A	N/A N/A N/A	CTDEP RSR FED-MCL CTDEP-MCL	NO	NUT, BKG
7440-47-3	Chromium-Filtered (7)	0.56	J	0.75	J	UG/L	S15GW15MW1S02-F	2/6	0.55 - 0.8	0.75	16.0	11 N	N/A 100 N/A	CTDEP RSR FED-MCL CTDEP-MCL	NO	BSL, BKG
7440-48-4	Cobalt-Filtered	6.8	J	7.5		UG/L	S15GW15TW101-F	2/6	5.1	7.5	43.3	73 N	N/A N/A N/A	CTDEP RSR FED-MCL CTDEP-MCL	NO	BSL, BKG
7440-50-8	Copper-Filtered	15.2		18.2		UG/L	S15GW15MW2S02-F-D	2/6	3.4	18.2	39.4	150 N	1300 1300 N/A	CTDEP RSR FED-MCL CTDEP-MCL	NO	BSL, BKG
7439-89-6	Iron-Filtered	135		6740	J	UG/L	S15GW15MW3S02-F	4/6	6.6 - 75.7	6740	25300	1100 N	N/A 300 N/A	CTDEP RSR FED-SMCL CTDEP-MCL	NO	BKG, EPAI
7439-92-1	Lead-Filtered	1.3	J	1.4		UG/L	S15GW15TW301-F	2/6	1.3	1.4	2.52	N/A	15 15 N/A	CTDEP RSR FED-AL CTDEP-MCL	NO	BSL, BKG
7439-95-4	Magnesium-Filtered	1120		3870		UG/L	S15GW15MW3S02-F	6/6	NA	3870	150000	N/A	N/A N/A N/A	CTDEP RSR FED-MCL CTDEP-MCL	NO	NUT, BKG
7439-96-5	Manganese-Filtered	4.2	J	703		UG/L	S15GW15TW301-F	6/6	NA	703	9400	88 N	N/A 50 N/A	CTDEP RSR FED-SMCL CTDEP-MCL	NO	BKG
7440-09-7	Potassium-Filtered	1420		5550		UG/L	S15GW15TW301-F	6/6	NA	5550	60000	N/A	N/A N/A N/A	CTDEP RSR FED-MCL CTDEP-MCL	NO	NUT, BKG
7440-23-5	Sodium-Filtered	14600	J	44900		UG/L	S15GW15TW201-F	6/6	NA	44900	1580000	N/A	N/A N/A N/A	CTDEP RSR FED-MCL CTDEP-MCL	NO	NUT, BKG
7440-66-6	Zinc-Filtered	3.2	J	362	J	UG/L	S15GW15MW2S02-F-D	4/6	1.6 - 2.3	362	109	1100 N	5000 5000 NA	CTDEP RSR FED-SMCL CTDEP-MCL	NO	BSL

From Basewide Groundwater Operable Unit Remedial Investigation Update/Feasibility Study (TtNUS, 2004).
A shaded value indicates that the concentration used for screening exceeds the criterion or background value.
A shaded chemical name indicates that the chemical has been selected as a COPC.

Footnotes:

- Sample and duplicate are counted as two separate samples when determining the minimum and maximum detected concentrations.
- Values presented are sample-specific quantitation limits.
- The maximum detected concentration is used for screening purposes.
- 95% Upper Tolerance Limit (UTL) of site background data.
- The risk-based COPC screening level for tap water use is presented. The value is based on a target Hazard Quotient of 0.1 for noncarcinogens (denoted with a "N" flag) or an incremental cancer risk of 1E-6 for carcinogens (denoted with a "C" flag) (EPA, 2002b). The PRG for noncarcinogenic compounds are divided by 10.

Definitions:

ARAR/TBC = Applicable or Relevant and Appropriate Requirement/To Be Considered.
C = Carcinogen.
COPC = Chemical of Potential Concern.
J = Estimated Value.
N = Noncarcinogen.
N/A = Not Applicable.
FED-MCL = Federal Maximum Contaminant Level (EPA, 2002a).
FED-SMCL = Federal Secondary Maximum Contaminant Level (EPA, 2002a).
FED-AL = Federal Action Level (EPA, 2002a).
CTDEP-RSR = CTDEP RSRs - Residential, 1996.
CTDEP-MCL = Connecticut Department of Public Health Maximum Contaminant Level.

TABLE 2-10

OCCURRENCE, DISTRIBUTION, AND SELECTION OF COPCs IN GROUNDWATER AT SITE 15
 DIRECT CONTACT EXPOSURE SCENARIOS
 SITES 3, 7, 14, 15, 18, AND 20 GROUNDWATER RECORD OF DECISION
 NSB-NLON, GROTON, CONNECTICUT
 PAGE 3 OF 3

Scenario Timeframe: Future Medium: Groundwater Exposure Medium: Groundwater Exposure Point: Site 15
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CAS Number	Chemical	Minimum Concentration ⁽¹⁾	Minimum Qualifier	Maximum Concentration ⁽¹⁾	Maximum Qualifier	Units	Location of Maximum Concentration	Detection Frequency	Range of Nondetects ⁽²⁾	Concentration Used for Screening ⁽³⁾	Background Value ⁽⁴⁾	Risk-Based COPC Screening Level ⁽⁵⁾	Potential ARAR/TBC Value	Potential ARAR/TBC Source	COPC Flag ⁽⁶⁾	Rationale for Contaminant Deletion or Selection
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6 The chemical is selected as a COPC if the maximum detected concentration exceeds the background value and the risk-based COPC screening level and/or an ARAR/TBC(s).

7 Hexavalent Chromium.

Associated Samples:

S15GW15MW1S02
 S15GW15MW1S02-F
 S15GW15MW2S02
 S15GW15MW2S02-D
 S15GW15MW2S02-F
 S15GW15MW2S02-F-D
 S15GW15MW3S02
 S15GW15MW3S02-F
 S15GW15TW101
 S15GW15TW101-F
 S15GW15TW201
 S15GW15TW201-F
 S15GW15TW301
 S15GW15TW301-F

Rationale Codes:

For Selection as a COPC:

ASL = Above COPC Screening Level/ARAR/TBC.

For Elimination as a COPC:

BKG = Less than Background Levels.

BSL = Below COPC Screening Level/ARAR/TBC.

NUT = Essential Nutrient.

EPAI = USEPA Region 1 does not advocate evaluation of this chemical.

TABLE 2-11

OCCURRENCE, DISTRIBUTION, AND SELECTION OF CHEMICALS OF POTENTIAL CONCERN IN GROUNDWATER AT SITE 15
MIGRATION PATHWAYS
SITES 3, 7, 14, 15, 18, AND 20 GROUNDWATER RECORD OF DECISION
NSB-NLON, GROTON, CONNECTICUT
PAGE 1 OF 2

Scenario Timeframe: Future
Medium: Groundwater
Exposure Medium: Groundwater
Exposure Point: Site 15

CAS Number	Chemical	Minimum Concentration ⁽¹⁾	Minimum Qualifier	Maximum Concentration ⁽¹⁾	Maximum Qualifier	Units	Location of Maximum Concentration	Detection Frequency	Range of Nondetects ⁽²⁾	Concentration Used for Screening ⁽³⁾	Background Value ⁽⁴⁾	CTDEP Surface Water Criteria ⁽⁵⁾	CTDEP Vol. Criteria ⁽⁶⁾	COPC Flag ⁽⁷⁾	Rationale for Contaminant Deletion or Selection
Volatile Organic Compounds															
67-66-3	Chloroform	3		3		UG/L	S15GW15TW301	1/6	1	3	N/A	14100	287	NO	BSL
Total Metals															
7429-90-5	Aluminum	2240	J	2820		UG/L	S15GW15MW2S02-D	2/6	37.4 - 137	2820	3560	N/A	N/A	NO	NTX, BKG
7440-39-3	Barium	31.4		85.1		UG/L	S15GW15MW1S02	6/6	NA	85.1	227	N/A	N/A	NO	NTX, BKG
7440-41-7	Beryllium	0.84		0.84		UG/L	S15GW15TW101	1/6	0.37 - 1.1	0.84	N/A	4	N/A	NO	BSL
7440-43-9	Cadmium	4.4		4.4		UG/L	S15GW15TW201	1/6	2.5 - 5	4.4	N/A	6	N/A	NO	BSL
7440-70-2	Calcium	8290		34200		UG/L	S15GW15TW301	6/6	NA	34200	188000	N/A	N/A	NO	NUT, BKG
7440-47-3	Chromium ⁽⁸⁾	0.87	J	0.87	J	UG/L	S15GW15MW1S02	1/6	0.55 - 1.1	0.87	49.9	110	N/A	NO	BSL, BKG
7440-48-4	Cobalt	7.3		9.5		UG/L	S15GW15TW101	3/6	5.1	9.5	48.6	N/A	N/A	NO	NTX, BKG
7440-50-8	Copper	13.9		21.3		UG/L	S15GW15MW2S02-D	2/6	3.4	21.3	107	48	N/A	NO	BSL, BKG
7439-89-6	Iron	215		7800		UG/L	S15GW15MW3S02	3/6	24.5 - 80.4	7800	28200	N/A	N/A	NO	NTX, BKG
7439-92-1	Lead	1.8		2.3		UG/L	S15GW15TW101	2/6	1.3	2.3	6.63	13	N/A	NO	BSL, BKG
7439-95-4	Magnesium	1210		3780		UG/L	S15GW15MW3S02	6/6	NA	3780	191000	N/A	N/A	NO	NUT, BKG
7439-96-5	Manganese	4.8		702		UG/L	S15GW15TW301	6/6	NA	702	11700	N/A	N/A	NO	NTX, BKG
7440-09-7	Potassium	1540		5700		UG/L	S15GW15TW301	6/6	NA	5700	70800	N/A	N/A	NO	NUT, BKG
7440-23-5	Sodium	22600		45400		UG/L	S15GW15TW201	6/6	NA	45400	1900000	N/A	N/A	NO	NUT, BKG
7440-66-6	Zinc	2.9	J	365		UG/L	S15GW15MW2S02-D	4/6	1.6 - 2.8	365	131	123	N/A	YES	ASL
Filtered Metals															
7429-90-5	Aluminum-Filtered	2160		2770	J	UG/L	S15GW15MW2S02-F-D	2/6	25.4 - 66.1	2770	64.4	N/A	N/A	NO	NTX
7440-39-3	Barium-Filtered	12.5		83.6		UG/L	S15GW15MW1S02-F	6/6	NA	83.6	124	N/A	N/A	NO	NTX, BKG
7440-41-7	Beryllium-Filtered	0.84		0.84		UG/L	S15GW15TW101-F	1/6	0.37 - 1.2	0.84	N/A	4	N/A	NO	BSL
7440-43-9	Cadmium-Filtered	6.4		6.4		UG/L	S15GW15TW201-F	1/6	2.5 - 6.3	6.4	N/A	6	N/A	YES	ASL
7440-70-2	Calcium-Filtered	5490		34700		UG/L	S15GW15TW301-F	6/6	NA	34700	152000	N/A	N/A	NO	NUT, BKG
7440-47-3	Chromium-Filtered ⁽⁸⁾	0.56	J	0.75	J	UG/L	S15GW15MW1S02-F	2/6	0.55 - 0.8	0.75	16.0	110	N/A	NO	BSL, BKG
7440-48-4	Cobalt-Filtered	6.8	J	7.5		UG/L	S15GW15TW101-F	2/6	5.1	7.5	43.3	N/A	N/A	NO	NTX, BKG
7440-50-8	Copper-Filtered	15.2		18.2		UG/L	S15GW15MW2S02-F-D	2/6	3.4	18.2	39.4	48	N/A	NO	BSL, BKG
7439-89-6	Iron-Filtered	135		6740	J	UG/L	S15GW15MW3S02-F	4/6	6.6 - 75.7	6740	25300	N/A	N/A	NO	NTX, BKG
7439-92-1	Lead-Filtered	1.3	J	1.4		UG/L	S15GW15TW301-F	2/6	1.3	1.4	2.52	13	N/A	NO	BSL, BKG
7439-95-4	Magnesium-Filtered	1120		3870		UG/L	S15GW15MW3S02-F	6/6	NA	3870	150000	N/A	N/A	NO	NUT, BKG
7439-96-5	Manganese-Filtered	4.2	J	703		UG/L	S15GW15TW301-F	6/6	NA	703	9400	N/A	N/A	NO	NTX, BKG
7440-09-7	Potassium-Filtered	1420		5550		UG/L	S15GW15TW301-F	6/6	NA	5550	60000	N/A	N/A	NO	NUT, BKG
7440-23-5	Sodium-Filtered	14600	J	44900		UG/L	S15GW15TW201-F	6/6	NA	44900	1580000	N/A	N/A	NO	NUT, BKG
7440-66-6	Zinc-Filtered	3.2	J	362	J	UG/L	S15GW15MW2S02-F-D	4/6	1.6 - 2.3	362	109	123	N/A	YES	ASL

From Basewide Groundwater Operable Unit Remedial Investigation Update/Feasibility Study (TINUS, 2004).
A shaded value indicates that the concentration used for screening exceeds the criterion or background value.
A shaded chemical name indicates that the chemical has been selected as a COPC.

Footnotes:

- Sample and duplicate are counted as two separate samples when determining the minimum and maximum detected concentrations.
- Values presented are sample-specific quantitation limits.
- The maximum detected concentration is used for screening purposes.
- 95% Upper Tolerance Limit (UTL) of site background data.
- Connecticut DEP Surface Water Protection criteria.
- Connecticut DEP Volatilization criteria for residential exposures.
- The chemical is selected as a COPC if the maximum detected concentration exceeds the background value and the CTDEP surface water protection or volatilization criteria.
- Hexavalent chromium.

Definitions:

ARAR/TBC = Applicable or Relevant and Appropriate Requirement/To Be Considered.
COPC = Chemical of Potential Concern.
J = Estimated Value.
N/A = Not Applicable.

Rationale Codes:

For Selection as a COPC:
ASL = Above COPC Screening Level/ARAR/TBC.

For Elimination as a COPC:

BKG = Less than Background Levels.
BSL = Below COPC Screening Level/ARAR/TBC.
NTX = No Toxicity Information.

TABLE 2-11

OCCURRENCE, DISTRIBUTION, AND SELECTION OF CHEMICALS OF POTENTIAL CONCERN IN GROUNDWATER AT SITE 15
MIGRATION PATHWAYS
SITES 3, 7, 14, 15, 18, AND 20 GROUNDWATER RECORD OF DECISION
NSB-NLON, GROTON, CONNECTICUT
PAGE 2 OF 2

Scenario Timeframe: Future
Medium: Groundwater
Exposure Medium: Groundwater
Exposure Point: Site 15

CAS Number	Chemical	Minimum Concentration ⁽¹⁾	Minimum Qualifier	Maximum Concentration ⁽¹⁾	Maximum Qualifier	Units	Location of Maximum Concentration	Detection Frequency	Range of Nondetects ⁽²⁾	Concentration Used for Screening ⁽³⁾	Background Value ⁽⁴⁾	CTDEP Surface Water Criteria ⁽⁵⁾	CTDEP Vol. Criteria ⁽⁶⁾	COPC Flag ⁽⁷⁾	Rationale for Contaminant Deletion or Selection
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NUT = Essential Nutrient.

Associated Samples:

S15GW15MW1S02
S15GW15MW1S02-F
S15GW15MW2S02
S15GW15MW2S02-D
S15GW15MW2S02-F
S15GW15MW2S02-F-D
S15GW15MW3S02
S15GW15MW3S02-F
S15GW15TW101
S15GW15TW101-F
S15GW15TW201
S15GW15TW201-F
S15GW15TW301
S15GW15TW301-F

TABLE 2-12

**TRENDS OF COPCs IN SITE 15 GROUNDWATER
SITES 3, 7, 14, 15, 18, AND 20 GROUNDWATER RECORD OF DECISION
NSB-NLON, GROTON, CONNECTICUT**

Sample Date	TCE	Cadmium	Chromium	Lead	Nickel	Silver	Zinc
15MW1S							
2/20/1994	10 U	2 U	3 U	2.1	10 U	2 U	2.9
6/27/1994	10 U	1.4	1.6	2 U	12 U	1 U	5.3
7/21/2000	3.22	0.99	121	24.7	77.6	5.2 U	24.4 U
10/14/2002	1 U	4.5 U	0.87	1.3 U	10.7 U	4.8 U	2.9
	Dissolved Metals (ug/L)						
2/20/1994	---	2 U	3 U	1 U	10 U	2 U	4.2 U
6/27/1994	---	2 U	3 U	2 U	7 U	2 U	6.5
7/21/2000	---	NA	NA	NA	NA	NA	NA
10/14/2002	---	3.2 U	0.75	1.3 U	10.7 U	4.8 U	3.2
15MW2S							
3/8/1994	10 U	4.9	3 U	3.1	10.6	2 U	423
6/26/1994	10 U	5.3	1 U	2 U	12 U	1 U	453
7/21/2000 ⁽¹⁾	2.76	3.3	16.05	14.1	22.35 U	308.98	322.5
10/14/2002	1 U	5 U	0.56 U	1.3 U	18.2 U	4.8 U	356
	Dissolved Metals (ug/L)						
2/20/1994	---	4.4	3 U	2 U	10 U	2 U	422
6/27/1994	---	5.5	3 U	2 U	10.6	2 U	450
7/21/2000	---	NA	NA	NA	NA	NA	NA
10/14/2002	---	2.7 U	0.56 U	1.3 U	10.7 U	4.8 U	50.5
15MW3S							
2/20/1994	10 U	2 U	5.9	21.2	10 U	2 U	20.3
6/26/1994	10 U	1.9	3.4	4.4 U	12 U	1 U	20.5
7/21/2000	16	0.25 U	21.1	4.2	13.8 U	215	26 U
10/14/2002	1 U	2.5 U	0.56 U	1.3 U	10.7 U	4.8 U	1.6 U
	Dissolved Metals (ug/L)						
2/20/1994	---	2 U	3 U	1.5 U	10 U	2 U	6.4 U
6/26/1994	---	2 U	3.1	2 U	7 U	2 U	11
7/21/2000	---	NA	NA	NA	NA	NA	NA
10/14/2002	---	2.5 U	0.56	1.3 U	10.7 U	4.8 U	1.6 U

From Basewide Groundwater Operable Unit Remedial Investigation Update/Feasibility Study (TtNUS, 2004).

NOTES: 1 The reported result is an average of the original sample and its duplicate.

NA Not Analyzed

--- Not applicable.

U Parameter not detected. The value reported is the detection limit.

TABLE 2-13

**SUMMARY OF SITE 15 WATER QUALITY DATA
SITES 3, 7, 14, 15, 18, AND 20 GROUNDWATER RECORD OF DECISION
NSB-NLON, GROTON, CONNECTICUT**

15MW1S	Pump Type	Water Level (ft below TOC)	Flow (mL/min)	pH (S.U.)	Turbidity (NTU)	DO (mg/L)	ORP (mV)	TSS (mg/L)	TDS (mg/L)	Total Iron (µg/L)	Dissolved Iron (µg/L)	Total Aluminum (µg/L)	Dissolved Aluminum (µg/L)
2/20/1994	NS	NS	NS	5.77	4	5.55	NS	NA	NA	182	50.0 U	228	14.0 U
6/27/1994	NS	NS	NS	5.21	123	5.08	NS	NA	NA	406	41	530	26.4
7/21/2000	R	5.60	200	5.75	3	6.11	147	5	215	1430	NA	683 U	NA
10/14/2002	P	7.42	175	5.57	0.5	7.31	118.2	NA	NA	24.5 U	12.0 U	37.4 U	25.4 U

15MW2S	Pump Type	Water Level (ft below TOC)	Flow (mL/min)	pH (S.U.)	Turbidity (NTU)	DO (mg/L)	ORP (mV)	TSS (mg/L)	TDS (mg/L)	Total Iron (µg/L)	Dissolved Iron (µg/L)	Total Aluminum (µg/L)	Dissolved Aluminum (µg/L)
3/8/1994	NS	NS	NS	4.95	68	7.32	NS	NA	NA	532	50.0 U	2250	2160
6/26/1994	NS	NS	NS	4.24	-10 ⁽²⁾	6.81	NS	NA	NA	83.1	35.2	2940	2980
7/21/2000	R	6.07	300	4.44	3.6	9.44	331	5 U ⁽¹⁾	158 ⁽¹⁾	248.5 U	NA	3330	NA
10/14/2002	P	7.88	200	4.41	1.6	8.79	371	NA	NA	34.72 U	1016.65 J	2800	1393.85 J

15MW3S	Pump Type	Water Level (ft below TOC)	Flow (mL/min)	pH (S.U.)	Turbidity (NTU)	DO (mg/L)	ORP (mV)	TSS (mg/L)	TDS (mg/L)	Total Iron (µg/L)	Dissolved Iron (µg/L)	Total Aluminum (µg/L)	Dissolved Aluminum (µg/L)
2/20/1994	NS	NS	NS	6.90	156	4.05	NS	NA	NA	7110	2720	4210	14.0 U
6/27/1994	NS	NS	NS	6.16	675	3.87	NS	NA	NA	3120	736	1870	32.4
7/21/2000	R	6.59	110	5.91	7	1.09	-25	30	10 U	8600	NA	1650	NA
10/14/2002	P	7.16	100	5.96	4.9	0.97	-36.2	NA	NA	7800	6740 J	58.7 U	25.4 U

From Basewide Groundwater Operable Unit Remedial Investigation Update/Feasibility Study (TtNUS, 2004).

NOTES: 1 The reported result is an average of the original sample and its duplicate.
2 Equipment problems.

NS	Not Specified	S.C.	Specific conductivity	mL/min	Milliliters per minute
NA	Not Analyzed	DO	Dissolved oxygen	S.U.	Standard units
P	Peristaltic Pump	ORP	Oxidation reduction potential	uS/cm	Microsiemens per centimeter
R	Redi-flo Grundfos Pump (2")	TSS	Total suspended solids	mg/L	Milligrams per liter
TOC	Top of Casing	NTU	Nephelometric turbidity units	mV	Millivolts
C	Celsius	ppt	Parts per thousand		

TABLE 2-14

**SUMMARY OF POSITIVE GROUNDWATER ANALYTICAL RESULTS FOR SITE 18
SITES 3, 7, 14, 15, 18, AND 20 GROUNDWATER RECORD OF DECISION
NSB-NLON, GROTON, CONNECTICUT**

location loc nsample sample sample_dat	18TB2/18TW2 18TW2 S18TW0201 S18TW0201 6/14/2000	18TB2/18TW2 18TW2 S18TW0201-D FD0614001 6/14/2000	18TB4/18TW4 18TW4 S18TW0401 S18TW0401 6/14/2000
ALUMINUM	189 U	211 U	880
BERYLLIUM	0.6 U	0.6 U	0.79 J
CALCIUM	25000	25200	9640
IRON	306	328	1030
MAGNESIUM	1590 U	1650 U	2630
MANGANESE	111	111	322
POTASSIUM	1660 U	1670 U	2570
SODIUM	9570	9900	15100
Miscellaneous Parameters (mg/L)			
TOTAL DISSOLVED SOLIDS	146	174	111
TOTAL SUSPENDED SOLIDS	5 U	5 U	39

From Basewide Groundwater Operable Unit Remedial Investigation Report (TtNUS, 2002a).

TABLE 2-15

OCCURRENCE, DISTRIBUTION, AND SELECTION OF CHEMICALS OF POTENTIAL CONCERN FOR GROUNDWATER AT SITE 18
DIRECT CONTACT EXPOSURE SCENARIOS
SITES 3, 7, 14, 15, 18, AND 20 GROUNDWATER RECORD OF DECISION
NSB-NLON, GROTON, CONNECTICUT

Scenario Timeframe: Future
Medium: Groundwater
Exposure Medium: Groundwater
Exposure Point: Solvent Storage Area (Site 18)

CAS Number	Chemical	Minimum Concentration ⁽¹⁾	Minimum Qualifier	Maximum Concentration ⁽¹⁾	Maximum Qualifier	Units	Location of Maximum Concentration	Detection Frequency ⁽¹⁾	Range of Nondetects ⁽²⁾	Concentration Used for Screening ⁽³⁾	Background Value ⁽⁴⁾	Risk-Based COPC Screening Level ⁽⁵⁾	Potential ARAR/TBC Value	Potential ARAR/TBC Source	COPC Flag	Rationale for Contaminant Deletion or Selection ⁽⁶⁾
Total Metals																
7429-90-5	ALUMINUM	880		880		ug/L	S18TW0401	1/2	189 - 211	880	3560	3600 N	N/A 50 to 200 N/A	CTDEP RSR FED-SMCL CTDEP-MCL	NO	EPAI, BKG
7440-41-7	BERYLLIUM	0.79	J	0.79	J	ug/L	S18TW0401	1/2	0.6	0.79	ND	7.3 N	4 4 4	CTDEP RSR FED-MCL CTDEP-MCL	NO	BSL
7440-70-2	CALCIUM	9640		25200		ug/L	S18TW0201-D	2/2	---	25200	188000	N/A	N/A N/A N/A	CTDEP RSR FED-MCL CTDEP-MCL	NO	NUT, BKG
7439-89-6	IRON	306		1030		ug/L	S18TW0401	2/2	---	1030	28200	1100 N	N/A 300 N/A	CTDEP RSR FED-SMCL CTDEP-MCL	NO	EPA1, BKG
7439-95-4	MAGNESIUM	2630		2630		ug/L	S18TW0401	1/2	1590 - 1650	2630	191000	N/A	N/A N/A N/A	CTDEP RSR FED-MCL CTDEP-MCL	NO	NUT, BKG
7439-96-5	MANGANESE	111		322		ug/L	S18TW0401	2/2	---	322	11700	88 N	N/A 50 N/A	CTDEP RSR FED-SMCL CTDEP-MCL	NO	BKG
7440-09-7	POTASSIUM	2570		2570		ug/L	S18TW0401	1/2	1660 - 1670	2570	70800	N/A	N/A N/A N/A	CTDEP RSR FED-MCL CTDEP-MCL	NO	NUT, BKG
7440-23-5	SODIUM	9570		15100		ug/L	S18TW0401	2/2	---	15100	1900000	N/A	N/A N/A N/A	CTDEP RSR FED-MCL CTDEP-MCL	NO	NUT, BKG
Miscellaneous Parameters																
000-09-0	TOTAL DISSOLVED SOLIDS	111		174		mg/L	S18TW0201-D	2/2	---	174	6260	N/A	N/A 500 N/A	CTDEP RSR FED-SMCL CTDEP-MCL	NO	NV
000-08-9	TOTAL SUSPENDED SOLIDS	39		39		mg/L	S18TW0401	1/2	5	39	236	N/A	N/A N/A N/A	CTDEP RSR FED-MCL CTDEP-MCL	NO	NTX

From Basewide Groundwater Operable Unit Remedial Investigation Report (TINUS, 2002a).

A shaded value indicates that the concentration used for screening exceeds the criterion or background value.

A shaded chemical name indicates that the chemical has been selected as a COPC.

Footnotes:

- Sample and duplicate are counted as two separate samples when determining the minimum and maximum detected concentrations.
- Values presented are sample-specific quantitation limits.
- The maximum detected concentration is used for screening purposes.
- 95% Upper Tolerance Limit (UTL) of site background data
- The risk-based COPC screening level for tap water use is presented. The value is based on a target Hazard Quotient of 0.1 for noncarcinogens (denoted with a "N" flag) or an incremental cancer risk of 1E-6 for carcinogens (denoted with a "C" flag) (EPA, 2000b).
- The chemical is selected as a COPC if the maximum detected concentration exceeds the risk-based COPC screening level and/or an ARAR/TBC(s).

Associated Samples:

S18TW0201
S18TW0201-D
S18TW0401

Rationale Codes:

For Selection as a COC:

ASL = Above COC Screening Level/ARAR/TBC

Definitions:

ARAR/TBC = Applicable or Relevant and Appropriate Requirement/To Be Considered.

C = Carcinogen.

COC = Chemical of Concern.

J = Estimated Value.

N = Noncarcinogen.

N/A = Not Applicable.

FED-MCL = Federal Maximum Contaminant Level (EPA, 2000a).

FED-SMCL = Federal Secondary Maximum Contaminant Level (EPA, 2000a).

FED-AL = Federal Action Level (EPA, 2000a).

CTDEP-RSR = Connecticut DEP Remediation Standard Regulations, 1996.

CTDEP-MCL = Connecticut Maximum Contaminant Level.

For Elimination as a COC:

BKG = Within Background Levels.

BSL = Below COC Screening Level/ARAR/TBC.

NUT = Essential Nutrient.

NTX = No Toxicity Information.

EPAI = USEPA Region 1 does not advocate evaluation of this chemical.

TABLE 2-16

OCCURRENCE, DISTRIBUTION, AND SELECTION OF CHEMICALS OF POTENTIAL CONCERN FOR GROUNDWATER AT SITE 18
MIGRATION PATHWAYS
SITES 3, 7, 14, 15, 18, AND 20 GROUNDWATER RECORD OF DECISION
NSB-NLON, GROTON, CONNECTICUT

Scenario Timeframe: Future
Medium: Groundwater
Exposure Medium: Groundwater
Exposure Point: Solvent Storage Area (Site 18)

CAS Number	Chemical	Minimum Concentration ⁽¹⁾	Minimum Qualifier	Maximum Concentration ⁽¹⁾	Maximum Qualifier	Units	Location of Maximum Concentration	Detection Frequency ⁽¹⁾	Range of Nondetects ⁽²⁾	Concentration Used for Screening ⁽³⁾	Background Value ⁽⁴⁾	CTDEP Surface Water Criteria ⁽⁵⁾	CTDEP Vol. Criteria ⁽⁶⁾	COPC Flag	Rationale for Contaminant Deletion or Selection ⁽⁶⁾
Total Metals															
7429-90-5	ALUMINUM	880		880		ug/L	S18TW0401	1/2	189 - 211	880	3560	N/A	N/A	NO	BKG
7440-41-7	BERYLLIUM	0.79	J	0.79	J	ug/L	S18TW0401	1/2	0.6	0.79	ND	4	NA	NO	BSL
7440-70-2	CALCIUM	9640		25200		ug/L	S18TW0201-D	2/2	---	25200	188000	N/A	N/A	NO	NTX, BKG
7439-89-6	IRON	306		1030		ug/L	S18TW0401	2/2	---	1030	28200	N/A	N/A	NO	NTX, BKG
7439-95-4	MAGNESIUM	2630		2630		ug/L	S18TW0401	1/2	1590 - 1650	2630	191000	N/A	N/A	NO	NTX, BKG
7439-96-5	MANGANESE	111		322		ug/L	S18TW0401	2/2	---	322	11700	N/A	N/A	NO	NTX, BKG
7440-09-7	POTASSIUM	2570		2570		ug/L	S18TW0401	1/2	1660 - 1670	2570	70800	N/A	N/A	NO	NTX, BKG
7440-23-5	SODIUM	9570		15100		ug/L	S18TW0401	2/2	---	15100	1900000	N/A	N/A	NO	NTX, BKG
Miscellaneous Parameters															
000-09-0	TOTAL DISSOLVED SOLIDS	111		174		mg/L	S18TW0201-D	2/2	---	174	6260	N/A	N/A	NO	NTX, BKG
000-08-9	TOTAL SUSPENDED SOLIDS	39		39		mg/L	S18TW0401	1/2	5	39	236	N/A	N/A	NO	NTX, BKG

From Basewide Groundwater Operable Unit Remedial Investigation Report (TtNUS, 2002a).

A shaded value indicates that the concentration used for screening exceeds the criterion or background value.

A shaded chemical name indicates that the chemical has been selected as a COPC.

Footnotes:

- 1 Sample and duplicate are counted as two separate samples when determining the minimum and maximum detected concentrations.
- 2 Values presented are sample-specific quantitation limits.
- 3 The maximum detected concentration is used for screening purposes.
- 4 95% Upper Tolerance Limit (UTL) of site background data.
- 5 Connecticut DEP Surface Water Protection criteria.
- 6 Connecticut DEP Volatilization criteria for residential exposures.
- 7 The chemical is selected as a COPC if the maximum detected concentration exceeds the CTDEP surface water protection or volatilization criteria.

Associated Samples:

S18TW0201
S18TW0201-D
S18TW0401

Definitions:

ARAR/TBC = Applicable or Relevant and Appropriate Requirement/To Be Considered.

C = Carcinogen.

COC = Chemical of Concern.

J = Estimated Value.

N = Noncarcinogen.

NA = Not Applicable.

Rationale Codes:

For Selection as a COPC:

ASL = Above COPC Screening Level/ARAR/TBC.

For Elimination as a COPC:

BKG = Within Background Levels.

BSL = Below COPC Screening Level/ARAR/TBC.

NTX = No Toxicity Information.

TABLE 2-17

OCCURRENCE, DISTRIBUTION, AND SELECTION OF COPCs FOR GROUNDWATER AT SITE 20
DIRECT CONTACT EXPOSURE SCENARIOS, BGOURI
SITES 3, 7, 14, 15, 18, AND 20 GROUNDWATER RECORD OF DECISION
NSB-NLON, GROTON, CONNECTICUT
PAGE 1 OF 3

Scenario Timeframe: Future
Medium: Groundwater
Exposure Medium: Groundwater
Exposure Point: Area A Weapons Center (Site 20)

CAS Number	Chemical	Minimum Concentration ⁽¹⁾	Minimum Qualifier	Maximum Concentration ⁽¹⁾	Maximum Qualifier	Units	Location of Maximum Concentration	Detection Frequency ⁽¹⁾	Range of Nondetects ⁽²⁾	Concentration Used for Screening ⁽³⁾	Background Value ⁽⁴⁾	Risk-Based COPC Screening Level ⁽⁵⁾	Potential ARAR/TBC Value	Potential ARAR/TBC Source	COPC Flag	Rationale for Contaminant Deletion or Selection ⁽⁶⁾
Volatile Organics																
108-10-1	4-METHYL-2-PENTANONE	1.29	J	1.29	J	ug/L	S202WCMW2S01	1/4	5	1.29	NA	16 N	7 N/A N/A	CTDEP RSR FED-MCL CTDEP-MCL	NO	BSL
79-01-6	TRICHLOROETHENE	3.8	J	5.02	J	ug/L	S202WCMW2S01	2/4	1	5.02	NA	1.6 C	5 5 5	CTDEP RSR FED-MCL CTDEP-MCL	YES	ASL
Semivolatile Organics																
106-44-5	4-METHYLPHENOL	9		9		ug/L	S202WCMW3S01	1/4	5	9	NA	18 N	35 N/A N/A	CTDEP RSR FED-MCL CTDEP-MCL	NO	BSL
56-55-3	BENZO(A)ANTHRACENE	0.04	J	0.04	J	ug/L	S202WCMW2S01	1/4	0.05	0.04	NA	0.092 C	0.06 N/A N/A	CTDEP RSR FED-MCL CTDEP-MCL	NO	BSL
50-32-8	BENZO(A)PYRENE	0.05		0.05		ug/L	S202WCMW2S01	1/4	0.05	0.05	NA	0.0092 C	0.2 0.2 N/A	CTDEP RSR FED-MCL CTDEP-MCL	YES	ASL
205-99-2	BENZO(B)FLUORANTHENE	0.08	J	0.08	J	ug/L	S202WCMW2S01	1/4	0.1	0.08	NA	0.092 C	0.08 N/A N/A	CTDEP RSR FED-MCL CTDEP-MCL	NO	BSL
191-24-2	BENZO(G,H,I)PERYLENE	0.07	J	0.07	J	ug/L	S202WCMW2S01	1/4	0.1	0.07	NA	18 (7) N	210 N/A N/A	CTDEP RSR FED-MCL CTDEP-MCL	NO	BSL
207-08-9	BENZO(K)FLUORANTHENE	0.03	J	0.03	J	ug/L	S202WCMW2S01	1/4	0.05	0.03	NA	0.92 C	0.5 N/A N/A	CTDEP RSR FED-MCL CTDEP-MCL	NO	BSL
218-01-9	CHRYSENE	0.05	J	0.05	J	ug/L	S202WCMW2S01	1/4	0.05	0.05	NA	9.2 C	4.8 N/A N/A	CTDEP RSR FED-MCL CTDEP-MCL	NO	BSL
206-44-0	FLUORANTHENE	0.13		0.13		ug/L	S202WCMW2S01	1/4	0.1	0.13	NA	150 N	280 N/A N/A	CTDEP RSR FED-MCL CTDEP-MCL	NO	BSL
193-39-5	INDENO(1,2,3-CD)PYRENE	0.07		0.07		ug/L	S202WCMW2S01	1/4	0.05	0.07	NA	0.092 C	0.5 N/A N/A	CTDEP RSR FED-MCL CTDEP-MCL	NO	BSL
85-01-8	PHENANTHRENE	0.04	J	0.04	J	ug/L	S202WCMW2S01	1/4	0.05	0.04	NA	18 (7) N	200 N/A N/A	CTDEP RSR FED-MCL CTDEP-MCL	NO	BSL
129-00-0	PYRENE	0.11		0.11		ug/L	S202WCMW2S01	1/4	0.05	0.11	NA	18 N	200 N/A N/A	CTDEP RSR FED-MCL CTDEP-MCL	NO	BSL
Total Metals																
7440-36-0	ANTIMONY	3.5	J	3.5	J	ug/L	S202WCMW3S01	1/4	2.6	3.5	2.90	1.5 N	6 6 6	CTDEP RSR FED-MCL CTDEP-MCL	YES	ASL
7440-38-2	ARSENIC	4.1	J	15.1		ug/L	S202WCMW1S01	2/4	2.3	15.1	1.92	0.045 C	50 50 ⁽⁹⁾ 50	CTDEP RSR FED-MCL CTDEP-MCL	YES	ASL
7440-39-3	BARIUM	83.5		83.5		ug/L	S202WCMW3S01	1/4	38.2 - 90	83.5	227	260 N	1000 2000 2000	CTDEP RSR FED-MCL CTDEP-MCL	NO	BSL, BKG
7440-70-2	CALCIUM	22500		160000		ug/L	S202WCMW3S01	4/4	0	160000	188000	N/A	N/A N/A N/A	CTDEP RSR FED-MCL CTDEP-MCL	NO	NUT, BKG
7440-47-3	CHROMIUM	26.9		29.2		ug/L	S202WCMW3S01	2/4	6.2	29.2	49.9	110 (8) N	50 100 N/A	CTDEP RSR FED-MCL CTDEP-MCL	NO	BSL, BKG

TABLE 2-17

OCCURRENCE, DISTRIBUTION, AND SELECTION OF COPCs FOR GROUNDWATER AT SITE 20
 DIRECT CONTACT EXPOSURE SCENARIOS, BGOURI
 SITES 3, 7, 14, 15, 18, AND 20 GROUNDWATER RECORD OF DECISION
 NSB-NLON, GROTON, CONNECTICUT
 PAGE 2 OF 3

Scenario Timeframe: Future
 Medium: Groundwater
 Exposure Medium: Groundwater
 Exposure Point: Area A Weapons Center (Site 20)

CAS Number	Chemical	Minimum Concentration ⁽¹⁾	Minimum Qualifier	Maximum Concentration ⁽¹⁾	Maximum Qualifier	Units	Location of Maximum Concentration	Detection Frequency ⁽¹⁾	Range of Nondetects ⁽²⁾	Concentration Used for Screening ⁽³⁾	Background Value ⁽⁴⁾	Risk-Based COPC Screening Level ⁽⁵⁾	Potential ARAR/TBC Value	Potential ARAR/TBC Source	COPC Flag	Rationale for Contaminant Deletion or Selection ⁽⁶⁾
7440-48-4	COBALT	18.8		18.8		ug/L	S202WCMW3S01	1/4	5.3 - 12	18.8	48.6	220 N	N/A N/A N/A	CTDEP RSR FED-MCL CTDEP-MCL	NO	BSL, BKG
7440-50-8	COPPER	9.1	J	66.6		ug/L	S202WCMW1S01	2/4	6.8	66.6	107	140 N	1300 1300 N/A	CTDEP RSR FED-MCL CTDEP-MCL	NO	BSL, BKG
7439-89-6	IRON	14900		40200		ug/L	S202WCMW1S01	3/4	188	40200	28200	1100 N	N/A 300 N/A	CTDEP RSR FED-SMCL CTDEP-MCL	NO	EPAI
7439-92-1	LEAD	8.9		8.9		ug/L	S202WCMW1S01	1/4	1.8	8.9	6.63	N/A	15 15 N/A	CTDEP RSR FED-AL CTDEP-MCL	NO	BSL
7439-95-4	MAGNESIUM	2640		138000		ug/L	S202WCMW3S01	4/4	0	138000	191000	N/A	N/A N/A N/A	CTDEP RSR FED-MCL CTDEP-MCL	NO	NUT, BKG
7439-96-5	MANGANESE	887		2170		ug/L	S202WCMW1S01	3/4	17.2	2170	11700	88 N	N/A 50 N/A	CTDEP RSR FED-SMCL CTDEP-MCL	NO	BKG
7440-02-0	NICKEL	13.7	J	102		ug/L	S202WCMW1S01	2/4	9.2	102	32.2	73 N	100 100 100	CTDEP RSR FED-MCL CTDEP-MCL	YES	ASL
7440-09-7	POTASSIUM	1440		100000		ug/L	S202WCMW3S01	4/4	0	100000	70800	N/A	N/A N/A N/A	CTDEP RSR FED-MCL CTDEP-MCL	NO	NUT
7440-22-4	SILVER	114	J	326	J	ug/L	S202WCMW1S01	2/4	5.2 - 6	326	ND	18 N	36 100 50	CTDEP RSR FED-SMCL CTDEP-MCL	YES	ASL
7440-23-5	SODIUM	9530		1220000	J	ug/L	S202WCMW3S01	4/4	0	1220000	1900000	N/A	N/A N/A N/A	CTDEP RSR FED-MCL CTDEP-MCL	NO	NUT, BKG
7440-28-0	THALLIUM	3.8	J	3.8	J	ug/L	S202WCMW3S01	1/4	3	3.8	ND	2.4 N	5 2 2	CTDEP RSR FED-MCL CTDEP-MCL	YES	ASL
7440-62-2	VANADIUM	10.2	J	10.2	J	ug/L	S202WCMW3S01	1/4	6.3 - 10.4	10.2	10.2	26 N	50 N/A N/A	CTDEP RSR FED-MCL CTDEP-MCL	NO	BSL, BKG
7440-66-6	ZINC	245		245		ug/L	S202WCMW1S01	1/4	13.5 - 24.6	245	131	1100 N	5000 5000 N/A	CTDEP RSR FED-SMCL CTDEP-MCL	NO	BSL
Dissolved Metals																
7440-70-2	CALCIUM, FILTERED	348	J	348	J	ug/L	S202WCMW3S01-F	1/1	0	348	152000	N/A	N/A N/A N/A	CTDEP RSR FED-MCL CTDEP-MCL	NO	NUT, BKG
7440-66-6	ZINC, FILTERED	53.4		53.4		ug/L	S202WCMW3S01-F	1/1	0	53.4	109	1100 N	5000 5000 N/A	CTDEP RSR FED-SMCL CTDEP-MCL	NO	BSL, BKG

TABLE 2-17

OCCURRENCE, DISTRIBUTION, AND SELECTION OF COPCs FOR GROUNDWATER AT SITE 20
DIRECT CONTACT EXPOSURE SCENARIOS, BGOURI
SITES 3, 7, 14, 15, 18, AND 20 GROUNDWATER RECORD OF DECISION
NSB-NLON, GROTON, CONNECTICUT
PAGE 3 OF 3

Scenario Timeframe: Future
Medium: Groundwater
Exposure Medium: Groundwater
Exposure Point: Area A Weapons Center (Site 20)

CAS Number	Chemical	Minimum Concentration ⁽¹⁾	Minimum Qualifier	Maximum Concentration ⁽¹⁾	Maximum Qualifier	Units	Location of Maximum Concentration	Detection Frequency ⁽¹⁾	Range of Nondetects ⁽²⁾	Concentration Used for Screening ⁽³⁾	Background Value ⁽⁴⁾	Risk-Based COPC Screening Level ⁽⁵⁾	Potential ARAR/TBC Value	Potential ARAR/TBC Source	COPC Flag	Rationale for Contaminant Deletion or Selection ⁽⁶⁾
Miscellaneous Parameters																
000-09-0	TOTAL DISSOLVED SOLIDS	135		5142	J	mg/L	S202WCMW3S01	4/4	0	5142	6260	N/A	N/A 500 N/A	CTDEP RSR FED-SMCL CTDEP-MCL	NO	BKG
000-08-9	TOTAL SUSPENDED SOLIDS	8		2788	J	mg/L	S202WCMW3S01	2/4	5	2788	236	N/A	N/A N/A N/A	CTDEP RSR FED-MCL CTDEP-MCL	NO	NTX

Taken from Basewide Groundwater Operable Unit Remedial Investigation Report (TINUS, 2002a).

A shaded value indicates that the concentration used for screening exceeds the criterion or background value.

A shaded chemical name indicates that the chemical has been selected as a COPC.

Footnotes:

- Sample and duplicate are counted as two separate samples when determining the minimum and maximum detected concentrations.
- Values presented are sample-specific quantitation limits.
- The maximum detected concentration is used for screening purposes.
- 95% Upper Tolerance Limit (UTL) of site background data.
- The risk-based COPC screening level for tap water use is presented. The value is based on a target Hazard Quotient of 0.1 for noncarcinogens (denoted with a "N" flag) or an incremental cancer risk of 1E-6 for carcinogens (denoted with a "C" flag) (EPA, 2000b).
- The chemical is selected as a COPC if the maximum detected concentration exceeds the risk-based COPC screening level and/or an ARAR/TBC(s).
- Pyrene is used as a surrogate for benzo(g,h,i)perylene and phenanthrene.
- Value is for hexavalent chromium.
- The EPA has approved a new MCL for arsenic of 10 ug/L. The MCL goes into effect in 2006. The reduction of the MCL does not impact the human health risk assessment.

Associated Samples:

S202WCMW1S01
S202WCMW2S01
S202WCMW3S01
S202WCMW3S01-F
S202WCMW4D01

Definitions:

ARAR/TBC = Applicable or Relevant and Appropriate Requirement/To Be Considered.

C = Carcinogen.

COC = Chemical of Concern.

J = Estimated Value.

N = Noncarcinogen.

N/A = Not Applicable.

FED-MCL = Federal Maximum Contaminant Level (EPA, 2000a).

FED-SMCL = Federal Secondary Maximum Contaminant Level (EPA, 2000a).

FED-AL = Federal Action Level (EPA, 2000a).

CTDEP-RSR = Connecticut DEP Remediation Standard Regulations, 1996.

CTDEP-MCL = Connecticut Maximum Contaminant Level.

Rationale Codes:

For Selection as a COC:

ASL = Above COC Screening Level/ARAR/TBC.

For Elimination as a COC:

BKG = Within Background Levels.

BSL = Below COC Screening Level/ARAR/TBC.

NUT = Essential Nutrient.

NTX = No Toxicity Information.

EPAL = USEPA Region one does not advocate evaluation of this chemical.

TABLE 2-18

OCCURRENCE, DISTRIBUTION, AND SELECTION OF COPCs FOR GROUNDWATER AT SITE 20
MIGRATION PATHWAYS, BGOURI
SITES 3, 7, 14, 15, 18, AND 20 GROUNDWATER RECORD OF DECISION
NSB-NLON, GROTON, CONNECTICUT
PAGE 1 OF 2

Scenario Timeframe: Future
Medium: Groundwater
Exposure Medium: Groundwater
Exposure Point: Area A Weapons Center (Site 20)

CAS Number	Chemical	Minimum Concentration ⁽¹⁾	Minimum Qualifier	Maximum Concentration ⁽¹⁾	Maximum Qualifier	Units	Location of Maximum Concentration	Detection Frequency ⁽¹⁾	Range of Nondetects ⁽²⁾	Concentration Used for Screening ⁽³⁾	Background Value ⁽⁴⁾	CTDEP Surface Water Criteria ⁽⁵⁾	CTDEP Vol. Criteria ⁽⁶⁾	COPC Flag	Rationale for Contaminant Deletion or Selection ⁽⁷⁾
Volatile Organics															
108-10-1	4-METHYL-2-PENTANONE	1.29	J	1.29	J	ug/L	S202WCMW2S01	1/4	5	1.29	N/A	N/A	N/A	NO	NTX
79-01-6	TRICHLOROETHENE	3.8	J	5.02	J	ug/L	S202WCMW2S01	2/4	1	5.02	N/A	2340	219	NO	BSL
Semivolatile Organics															
106-44-5	4-METHYLPHENOL	9		9		ug/L	S202WCMW3S01	1/4	5	9	N/A	N/A	N/A	NO	NTX
56-55-3	BENZO(A)ANTHRACENE	0.04	J	0.04	J	ug/L	S202WCMW2S01	1/4	0.05	0.04	N/A	0.3	N/A	NO	BSL
50-32-8	BENZO(A)PYRENE	0.05		0.05		ug/L	S202WCMW2S01	1/4	0.05	0.05	N/A	0.3	N/A	NO	BSL
205-99-2	BENZO(B)FLUORANTHENE	0.08	J	0.08	J	ug/L	S202WCMW2S01	1/4	0.1	0.08	N/A	0.3	N/A	NO	BSL
191-24-2	BENZO(G,H,I)PERYLENE	0.07	J	0.07	J	ug/L	S202WCMW2S01	1/4	0.1	0.07	N/A	N/A	N/A	NO	NTX
207-08-9	BENZO(K)FLUORANTHENE	0.03	J	0.03	J	ug/L	S202WCMW2S01	1/4	0.05	0.03	N/A	0.3	N/A	NO	BSL
218-01-9	CHRYSENE	0.05	J	0.05	J	ug/L	S202WCMW2S01	1/4	0.05	0.05	N/A	N/A	N/A	NO	NTX
206-44-0	FLUORANTHENE	0.13		0.13		ug/L	S202WCMW2S01	1/4	0.1	0.13	N/A	3700	N/A	NO	BSL
193-39-5	INDENO(1,2,3-CD)PYRENE	0.07		0.07		ug/L	S202WCMW2S01	1/4	0.05	0.07	N/A	N/A	N/A	NO	NTX
85-01-8	PHENANTHRENE	0.04	J	0.04	J	ug/L	S202WCMW2S01	1/4	0.05	0.04	N/A	0.3	N/A	NO	BSL
129-00-0	PYRENE	0.11		0.11		ug/L	S202WCMW2S01	1/4	0.05	0.11	N/A	110000	N/A	NO	BSL
Total Metals															
7440-36-0	ANTIMONY	3.5	J	3.5	J	ug/L	S202WCMW3S01	1/4	2.6	3.5	2.90	86000	N/A	NO	BSL
7440-38-2	ARSENIC	4.1	J	15.1		ug/L	S202WCMW1S01	2/4	2.3	15.1	1.92	4	N/A	YES	ASL
7440-39-3	BARIUM	83.5		83.5		ug/L	S202WCMW3S01	1/4	38.2 - 90	83.5	227	N/A	N/A	NO	BKG
7440-70-2	CALCIUM	22500		160000		ug/L	S202WCMW3S01	4/4	N/A	160000	188000	N/A	N/A	NO	BKG
7440-47-3	CHROMIUM	26.9		29.2		ug/L	S202WCMW3S01	2/4	6.2	29.2	49.9	N/A	N/A	NO	BKG
7440-48-4	COBALT	18.8		18.8		ug/L	S202WCMW3S01	1/4	5.3 - 12	18.8	48.6	N/A	N/A	NO	BKG
7440-50-8	COPPER	9.1	J	66.6		ug/L	S202WCMW1S01	2/4	6.8	66.6	107	48	N/A	NO	BKG
7439-89-6	IRON	14900		40200		ug/L	S202WCMW1S01	3/4	188	40200	28200	N/A	N/A	NO	NTX
7439-92-1	LEAD	8.9		8.9		ug/L	S202WCMW1S01	1/4	1.8	8.9	6.63	13	N/A	NO	BSL
7439-95-4	MAGNESIUM	2640		138000		ug/L	S202WCMW3S01	4/4	N/A	138000	191000	N/A	N/A	NO	BKG
7439-96-5	MANGANESE	887		2170		ug/L	S202WCMW1S01	3/4	17.2	2170	11700	N/A	N/A	NO	BKG
7440-02-0	NICKEL	13.7	J	102		ug/L	S202WCMW1S01	2/4	9.2	102	32.2	880	N/A	NO	BSL
7440-09-7	POTASSIUM	1440		100000		ug/L	S202WCMW3S01	4/4	N/A	100000	70800	N/A	N/A	NO	NTX
7440-22-4	SILVER	114	J	326	J	ug/L	S202WCMW1S01	2/4	5.2 - 6	326	ND	12	N/A	YES	ASL
7440-23-5	SODIUM	9530		1220000		ug/L	S202WCMW3S01	4/4	N/A	1220000	1900000	N/A	N/A	NO	BKG
7440-28-0	THALLIUM	3.8	J	3.8	J	ug/L	S202WCMW3S01	1/4	3	3.8	ND	63	N/A	NO	BSL
7440-62-2	VANADIUM	10.2	J	10.2	J	ug/L	S202WCMW3S01	1/4	6.3 - 10.4	10.2	10.2	N/A	N/A	NO	NTX
7440-66-6	ZINC	245		245		ug/L	S202WCMW1S01	1/4	13.5 - 24.6	245	131	123	N/A	YES	ASL
Dissolved Metals															
7440-70-2	CALCIUM, FILTERED	348	J	348	J	ug/L	S202WCMW3S01-F	1/1	N/A	348	152000	N/A	N/A	NO	BKG
7440-66-6	ZINC, FILTERED	53.4		53.4		ug/L	S202WCMW3S01-F	1/1	N/A	53.4	109	123	N/A	NO	BSL, BKG
Miscellaneous Parameters															
000-09-0	TOTAL DISSOLVED SOLIDS	135		5142	J	mg/L	S202WCMW3S01	4/4	N/A	5142	6260	N/A	N/A	NO	BKG
000-08-9	TOTAL SUSPENDED SOLIDS	8		2788	J	mg/L	S202WCMW3S01	2/4	5	2788	236	N/A	N/A	NO	NTX

TABLE 2-18
 OCCURRENCE, DISTRIBUTION, AND SELECTION OF COPCs FOR GROUNDWATER AT SITE 20
 MIGRATION PATHWAYS, BGOURI
 SITES 3, 7, 14, 15, 18, AND 20 GROUNDWATER RECORD OF DECISION
 NSB-NLON, GROTON, CONNECTICUT
 PAGE 2 OF 2

Taken from Basewide Groundwater Operable Unit Remedial Investigation Report (TINUS, 2002a).
 A shaded value indicates that the concentration used for screening exceeds the criterion or background value.
 A shaded chemical name indicates that the chemical has been selected as a COPC.

Footnotes:

- 1 Sample and duplicate are counted as two separate samples when determining the minimum and maximum detected concentrations.
- 2 Values presented are sample-specific quantitation limits.
- 3 The maximum detected concentration is used for screening purposes.
- 4 95% Upper Tolerance Limit (UTL) of site background data.
- 5 Connecticut DEP Surface Water Protection criteria.
- 6 Connecticut DEP Volatilization criteria for residential exposures.
- 7 The chemical is selected as a COPC if the maximum detected concentration exceeds the CTDEP surface water protection or volatilization criteria.

Associated Samples:

S202WCMW1S01
 S202WCMW2S01
 S202WCMW3S01
 S202WCMW3S01-F
 S202WMW4D01

Definitions:

ARAR/TBC = Applicable or Relevant and Appropriate Requirement/To Be Considered.
 C = Carcinogen.
 COC = Chemical of Concern.
 J = Estimated Value.
 N = Noncarcinogen.
 NA = Not Applicable.

Rationale Codes:

For Selection as a COPC:
 ASL = Above COPC Screening Level/ARAR/TBC.

For Elimination as a COPC:
 BKG = Within Background Levels.
 BSL = Below COPC Screening Level/ARAR/TBC.
 NTX = No Toxicity Information.

TABLE 2-19

**SUMMARY OF GROUNDWATER ANALYTICAL RESULTS FOR SITE 20
SITES 3, 7, 14, 15, 18, AND 20 GROUNDWATER RECORD OF DECISION
NSB-NLON, GROTON, CONNECTICUT**

location	2WCMW1S	2WCMW1S	2WCMW2S	2WCMW2S
nsample	S20GW2WCMW1S02	S20GW2WCMW1S02-F	S20GW2WCMW2S02	S20GW2WCMW2S02-F
sample	S20GW2WCMW1S02	S20GW2WCMW1S02-F	S20GW2WCMW2S02	S20GW2WCMW2S02-F
sample_dat	10/16/2002	10/16/2002	10/17/2002	10/17/2002
Inorganics (ug/L)				
ALUMINUM	180 U		257	
ARSENIC	3.2 J		2.0 U	
BARIUM	81.4		14.4	
CALCIUM	166000		5410	
CHROMIUM	3.4		0.61 J	
COPPER	3.4 U		3.6 J	
IRON	50900		2970	
LEAD	1.3 U		2.3 J	
MAGNESIUM	41200		1210	
MANGANESE	2350		216	
POTASSIUM	44000		1390	
SODIUM	353000		15200	
ZINC	4.1		58.0	
Filtered Inorganics (ug/L)				
ALUMINUM		41.0 U		2760 J
ARSENIC		3.4 J		2.0 U
BARIUM		85.2		52.0
CALCIUM		191000		12000
CHROMIUM		2.1		0.55 U
COBALT		5.1 U		9.3 J
COPPER		3.4 U		18.9
IRON		38000 J		7.7 U
MAGNESIUM		33500		2010
MANGANESE		2220 J		225 J
POTASSIUM		29100		1840
SODIUM		190000 J		35200 J
ZINC		2.3 J		361 J

Taken from Basewide Groundwater Operable Unit Remedial Investigation Update/Feasibility Study Report (TtNUS, 2004).

TABLE 2-20

OCCURRENCE, DISTRIBUTION, AND SELECTION OF COPCs IN GROUNDWATER AT SITE 20
 DIRECT CONTACT EXPOSURE SCENARIOS, BGOURI UPDATE/FS
 SITES 3, 7, 14, 15, 18, AND 20 GW ROD
 NSB-NLON, GROTON, CONNECTICUT
 PAGE 1 OF 2

Scenario Timeframe: Future
 Medium: Groundwater
 Exposure Medium: Groundwater
 Exposure Point: Site 20

CAS Number	Chemical	Minimum Concentration ⁽¹⁾	Minimum Qualifier	Maximum Concentration ⁽¹⁾	Maximum Qualifier	Units	Location of Maximum Concentration	Detection Frequency	Range of Nondetects ⁽²⁾	Concentration Used for Screening ⁽³⁾	Background Value ⁽⁴⁾	Risk-Based COPC Screening Level ⁽⁵⁾	Potential ARAR/TBC Value	Potential ARAR/TBC Source	COPC Flag ⁽⁶⁾	Rationale for Contaminant Deletion or Selection
Total Metals																
7429-90-5	Aluminum	257		257		UG/L	S20GW2WCMW2S02	1/2	180	257	3560	3600 N	N/A 50 to 200	CTDEP RSR FED-SMCL CTDEP-MCL	NO	BKG, EPAI
7440-38-2	Arsenic	3.2	J	3.2	J	UG/L	S20GW2WCMW1S02	1/2	2	3.2	1.92	0.045 C	50 10 50	CTDEP RSR FED-MCL CTDEP-MCL	YES	ASL
7440-39-3	Barium	14.4		81.4		UG/L	S20GW2WCMW1S02	2/2	NA	81.4	227	260 N	1000 2000 2000	CTDEP RSR FED-MCL CTDEP-MCL	NO	BSL, BKG
7440-70-2	Calcium	5410		166000		UG/L	S20GW2WCMW1S02	2/2	NA	166000	188000	N/A	N/A N/A N/A	CTDEP RSR FED-MCL CTDEP-MCL	NO	NUT, BKG
7440-47-3	Chromium ⁽⁷⁾	0.61	J	3.4		UG/L	S20GW2WCMW1S02	2/2	NA	3.4	49.9	11 N	N/A 100 N/A	CTDEP RSR FED-MCL CTDEP-MCL	NO	BSL, BKG
7440-50-8	Copper	3.6	J	3.6	J	UG/L	S20GW2WCMW2S02	1/2	3.4	3.6	107	150 N	1300 1300 N/A	CTDEP RSR FED-MCL CTDEP-MCL	NO	BSL, BKG
7439-89-6	Iron	2970		50900		UG/L	S20GW2WCMW1S02	2/2	NA	50900	28200	1100 N	N/A 300	CTDEP RSR FED-SMCL CTDEP-MCL	NO	EPAI
7439-92-1	Lead	2.3	J	2.3	J	UG/L	S20GW2WCMW2S02	1/2	1.3	2.3	6.63	N/A	15 15 N/A	CTDEP RSR FED-AL CTDEP-MCL	NO	BSL, BKG
7439-95-4	Magnesium	1210		41200		UG/L	S20GW2WCMW1S02	2/2	NA	41200	191000	N/A	N/A N/A N/A	CTDEP RSR FED-MCL CTDEP-MCL	NO	NUT, BKG
7439-96-5	Manganese	216		2350		UG/L	S20GW2WCMW1S02	2/2	NA	2350	11700	88 N	N/A 50	CTDEP RSR FED-SMCL CTDEP-MCL	NO	BKG
7440-09-7	Potassium	1390		44000		UG/L	S20GW2WCMW1S02	2/2	NA	44000	70800	N/A	N/A N/A N/A	CTDEP RSR FED-MCL CTDEP-MCL	NO	NUT, BKG
7440-23-5	Sodium	15200		353000		UG/L	S20GW2WCMW1S02	2/2	NA	353000	1900000	N/A	N/A N/A N/A	CTDEP RSR FED-MCL CTDEP-MCL	NO	NUT, BKG
7440-66-6	Zinc	4.1		58		UG/L	S20GW2WCMW2S02	2/2	NA	58	131	1100 N	5000 5000 NA	CTDEP RSR FED-SMCL CTDEP-MCL	NO	BSL, BKG
Filtered Metals																
7429-90-5	Aluminum-Filtered	2760	J	2760	J	UG/L	S20GW2WCMW2S02-F	1/2	41	2760	64.4	3600 N	N/A 50 to 200	CTDEP RSR FED-SMCL CTDEP-MCL	NO	EPAI
7440-38-2	Arsenic-Filtered	3.4	J	3.4	J	UG/L	S20GW2WCMW1S02-F	1/2	2	3.4	2.55	0.045 C	50 10 50	CTDEP RSR FED-MCL CTDEP-MCL	YES	ASL
7440-39-3	Barium-Filtered	52		85.2		UG/L	S20GW2WCMW1S02-F	2/2	NA	85.2	124	260 N	1000 2000 2000	CTDEP RSR FED-MCL CTDEP-MCL	NO	BSL, BKG
7440-70-2	Calcium-Filtered	12000		191000		UG/L	S20GW2WCMW1S02-F	2/2	NA	191000	152000	N/A	N/A N/A N/A	CTDEP RSR FED-MCL CTDEP-MCL	NO	NUT
7440-47-3	Chromium-Filtered ⁽⁷⁾	2.1		2.1		UG/L	S20GW2WCMW1S02-F	1/2	0.55	2.1	16.0	11 N	N/A 100 N/A	CTDEP RSR FED-MCL CTDEP-MCL	NO	BSL, BKG

TABLE 2-20

OCCURRENCE, DISTRIBUTION, AND SELECTION OF COPCS IN GROUNDWATER AT SITE 20
DIRECT CONTACT EXPOSURE SCENARIOS, BGOURI UPDATE/FS
SITES 3, 7, 14, 15, 18, AND 20 GW ROD
NSB-NLON, GROTON, CONNECTICUT
PAGE 2 OF 2

Scenario Timeframe: Future
Medium: Groundwater
Exposure Medium: Groundwater
Exposure Point: Site 20

CAS Number	Chemical	Minimum Concentration ⁽¹⁾	Minimum Qualifier	Maximum Concentration ⁽¹⁾	Maximum Qualifier	Units	Location of Maximum Concentration	Detection Frequency	Range of Nondetects ⁽²⁾	Concentration Used for Screening ⁽³⁾	Background Value ⁽⁴⁾	Risk-Based COPC Screening Level ⁽⁵⁾	Potential ARAR/TBC Value	Potential ARAR/TBC Source	COPC Flag ⁽⁶⁾	Rationale for Contaminant Deletion or Selection
7440-48-4	Cobalt-Filtered	9.3	J	9.3	J	UG/L	S20GW2WCMW2S02-F	1/2	5.1	9.3	43.3	73 N	N/A N/A N/A	CTDEP RSR FED-MCL CTDEP-MCL	NO	BSL, BKG
7440-50-8	Copper-Filtered	18.9		18.9		UG/L	S20GW2WCMW2S02-F	1/2	3.4	18.9	39.4	150 N	1300 1300 N/A	CTDEP RSR FED-MCL CTDEP-MCL	NO	BSL, BKG
7439-89-6	Iron-Filtered	38000	J	38000	J	UG/L	S20GW2WCMW1S02-F	1/2	7.7	38000	25300	1100 N	N/A 300 N/A	CTDEP RSR FED-SMCL CTDEP-MCL	NO	EPAI
7439-95-4	Magnesium-Filtered	2010		33500		UG/L	S20GW2WCMW1S02-F	2/2	NA	33500	150000	N/A	N/A N/A N/A	CTDEP RSR FED-MCL CTDEP-MCL	NO	NUT, BKG
7439-96-5	Manganese-Filtered	225	J	2220	J	UG/L	S20GW2WCMW1S02-F	2/2	NA	2220	9400	88 N	N/A 50 N/A	CTDEP RSR FED-SMCL CTDEP-MCL	NO	BKG
7440-09-7	Potassium-Filtered	1840		29100		UG/L	S20GW2WCMW1S02-F	2/2	NA	29100	60000	N/A	N/A N/A N/A	CTDEP RSR FED-MCL CTDEP-MCL	NO	NUT, BKG
7440-23-5	Sodium-Filtered	35200	J	190000	J	UG/L	S20GW2WCMW1S02-F	2/2	NA	190000	1580000	N/A	N/A N/A N/A	CTDEP RSR FED-MCL CTDEP-MCL	NO	NUT, BKG
7440-66-6	Zinc-Filtered	2.3	J	361	J	UG/L	S20GW2WCMW2S02-F	2/2	NA	361	109	1100 N	5000 5000 NA	CTDEP RSR FED-SMCL CTDEP-MCL	NO	BSL

Taken from Basewide Groundwater Operable Unit Remedial Investigation Update/Feasibility Study (TtNUS, 2004).

A shaded value indicates that the concentration used for screening exceeds the criterion or background value.

A shaded chemical name indicates that the chemical has been selected as a COPC.

Footnotes:

- Sample and duplicate are counted as two separate samples when determining the minimum and maximum detected concentrations.
- Values presented are sample-specific quantitation limits.
- The maximum detected concentration is used for screening purposes.
- 95% Upper Tolerance Limit (UTL) of site background data.
- The risk-based COPC screening level for tap water use is presented. The value is based on a target Hazard Quotient of 0.1 for noncarcinogens (denoted with a "N" flag) or an incremental cancer risk of 1E-6 for carcinogens (denoted with a "C" flag) (EPA, 2002b). PRGs for noncarcinogenic compounds are divided by ten.
- The chemical is selected as a COPC if the maximum detected concentration exceeds the risk-based the background value, COPC screening level and/or an ARAR/TBC(s).
- Hexavalent chromium.

Associated Samples:
S20GW2WCMW1S02
S20GW2WCMW1S02-F
S20GW2WCMW2S02
S20GW2WCMW2S02-F

Definitions:

ARAR/TBC = Applicable or Relevant and Appropriate Requirement/To Be Considered.

C = Carcinogen.

COPC = Chemical of Potential Concern.

J = Estimated Value.

N = Noncarcinogen.

N/A = Not Applicable.

FED-MCL = Federal Maximum Contaminant Level (EPA, 2002a).

FED-SMCL = Federal Secondary Maximum Contaminant Level (EPA, 2002a).

FED-AL = Federal Action Level (EPA, 2002a).

CTDEP-RSR = CTDEP RSRs - Residential, 1996.

CTDEP-MCL = Connecticut Department of Public Health Maximum Contaminant Level.

Rationale Codes:

For Selection as a COPC:

ASL = Above COPC Screening Level/ARAR/TBC.

For Elimination as a COPC:

BKG = Less than Background Levels.

BSL = Below COPC Screening Level/ARAR/TBC.

NUT = Essential Nutrient.

EPAI = USEPA Region 1 does not advocate evaluation of this chemical.

TABLE 2-21

OCCURRENCE, DISTRIBUTION, AND SELECTION OF CHEMICALS OF POTENTIAL CONCERN IN GROUNDWATER AT SITE 20
MIGRATION PATHWAYS, BGOURI UPDATE/FS
SITES 3, 7, 14, 15, 18, AND 20 GROUNDWATER RECORD OF DECISION
NSB-NLON, GROTON, CONNECTICUT

Scenario Timeframe: Future
Medium: Groundwater
Exposure Medium: Groundwater
Exposure Point: Site 20

CAS Number	Chemical	Minimum Concentration ⁽¹⁾	Minimum Qualifier	Maximum Concentration ⁽¹⁾	Maximum Qualifier	Units	Location of Maximum Concentration	Detection Frequency	Range of Nondetects ⁽²⁾	Concentration Used for Screening ⁽³⁾	Background Value ⁽⁴⁾	CTDEP Surface Water Criteria ⁽⁵⁾	CTDEP Vol. Criteria ⁽⁶⁾	COPC Flag ⁽⁷⁾	Rationale for Contaminant Deletion or Selection
Total Metals															
7429-90-5	Aluminum	257		257		UG/L	S20GW2WCMW2S02	1/2	180	257	3560	N/A	N/A	NO	NTX, BKG
7440-38-2	Arsenic	3.2	J	3.2	J	UG/L	S20GW2WCMW1S02	1/2	2	3.2	1.92	4	N/A	NO	BSL
7440-39-3	Barium	14.4		81.4		UG/L	S20GW2WCMW1S02	2/2	NA	81.4	227	N/A	N/A	NO	NTX, BKG
7440-70-2	Calcium	5410		166000		UG/L	S20GW2WCMW1S02	2/2	NA	166000	188000	N/A	N/A	NO	NUT, BKG
7440-47-3	Chromium ⁽⁸⁾	0.61	J	3.4		UG/L	S20GW2WCMW1S02	2/2	NA	3.4	49.9	110	N/A	NO	BSL BKG
7440-50-8	Copper	3.6	J	3.6	J	UG/L	S20GW2WCMW2S02	1/2	3.4	3.6	107	48	N/A	NO	BSL, BKG
7439-89-6	Iron	2970		50900		UG/L	S20GW2WCMW1S02	2/2	NA	50900	28200	N/A	N/A	NO	NTX
7439-92-1	Lead	2.3	J	2.3	J	UG/L	S20GW2WCMW2S02	1/2	1.3	2.3	6.63	13	N/A	NO	BSL, BKG
7439-95-4	Magnesium	1210		41200		UG/L	S20GW2WCMW1S02	2/2	NA	41200	191000	N/A	N/A	NO	NUT, BKG
7439-96-5	Manganese	216		2350		UG/L	S20GW2WCMW1S02	2/2	NA	2350	11700	N/A	N/A	NO	NTX, BKG
7440-09-7	Potassium	1390		44000		UG/L	S20GW2WCMW1S02	2/2	NA	44000	70800	N/A	N/A	NO	NUT, BKG
7440-23-5	Sodium	15200		353000		UG/L	S20GW2WCMW1S02	2/2	NA	353000	1900000	N/A	N/A	NO	NUT, BKG
7440-66-6	Zinc	4.1		58		UG/L	S20GW2WCMW2S02	2/2	NA	58	131	123	N/A	NO	BSL, BKG
Filtered Metals															
7429-90-5	Aluminum-Filtered	2760	J	2760	J	UG/L	S20GW2WCMW2S02-F	1/2	41	2760	64.4	N/A	N/A	NO	NTX
7440-38-2	Arsenic-Filtered	3.4	J	3.4	J	UG/L	S20GW2WCMW1S02-F	1/2	2	3.4	2.55	4	N/A	NO	BSL
7440-39-3	Barium-Filtered	52		85.2		UG/L	S20GW2WCMW1S02-F	2/2	NA	85.2	124	N/A	N/A	NO	NTX, BKG
7440-70-2	Calcium-Filtered	12000		191000		UG/L	S20GW2WCMW1S02-F	2/2	NA	191000	152000	N/A	N/A	NO	NUT
7440-47-3	Chromium-Filtered ⁽⁸⁾	2.1		2.1		UG/L	S20GW2WCMW1S02-F	1/2	0.55	2.1	16.0	110	N/A	NO	BSL, BKG
7440-48-4	Cobalt-Filtered	9.3	J	9.3	J	UG/L	S20GW2WCMW2S02-F	1/2	5.1	9.3	43.3	N/A	N/A	NO	NTX, BKG
7440-50-8	Copper-Filtered	18.9		18.9		UG/L	S20GW2WCMW2S02-F	1/2	3.4	18.9	39.4	48	N/A	NO	BSL, BKG
7439-89-6	Iron-Filtered	38000	J	38000	J	UG/L	S20GW2WCMW1S02-F	1/2	7.7	38000	25300	N/A	N/A	NO	NTX
7439-95-4	Magnesium-Filtered	2010		33500		UG/L	S20GW2WCMW1S02-F	2/2	NA	33500	150000	N/A	N/A	NO	NUT, BKG
7439-96-5	Manganese-Filtered	225	J	2220	J	UG/L	S20GW2WCMW1S02-F	2/2	NA	2220	9400	N/A	N/A	NO	NTX, BKG
7440-09-7	Potassium-Filtered	1840		29100		UG/L	S20GW2WCMW1S02-F	2/2	NA	29100	60000	N/A	N/A	NO	NUT, BKG
7440-23-5	Sodium-Filtered	35200	J	190000	J	UG/L	S20GW2WCMW1S02-F	2/2	NA	190000	1580000	N/A	N/A	NO	NUT, BKG
7440-66-6	Zinc-Filtered	2.3	J	361	J	UG/L	S20GW2WCMW2S02-F	2/2	NA	361	109	123	N/A	YES	ASL

Taken from Basewide Groundwater Operable Unit Remedial Investigation Update/Feasibility Study (TtNUS, 2004).

A shaded value indicates that the concentration used for screening exceeds the criterion or background value.

A shaded chemical name indicates that the chemical has been selected as a COPC.

Footnotes:

- Sample and duplicate are counted as two separate samples when determining the minimum and maximum detected concentrations.
- Values presented are sample-specific quantitation limits.
- The maximum detected concentration is used for screening purposes.
- 95% Upper Tolerance Limit (UTL) of site background data.
- CTDEP Surface Water Protection criteria.
- Connecticut DEP Volatilization criteria for residential exposures.
- The chemical is selected as a COPC if the maximum detected concentration exceeds the background value and the CTDEP surface water protection or volatilization criteria.
- Hexavalent Chromium.

Associated Samples:

S20GW2WCMW1S02
S20GW2WCMW1S02-F
S20GW2WCMW2S02
S20GW2WCMW2S02-F

Definitions:

ARAR/TBC = Applicable or Relevant and Appropriate Requirement/To Be Considered.

COPC = Chemical of Potential Concern.

J = Estimated Value.

N/A = Not Applicable.

Rationale Codes:

For Selection as a COPC:

ASL = Above COPC Screening Level/ARAR/TBC.

For Elimination as a COPC:

BKG = Less than Background Levels.

BSL = Below COPC Screening Level/ARAR/TBC.

NTX = No Toxicity Information.

NUT = Essential Nutrient.

TABLE 2-22

**TRENDS OF COPCs IN SITE 20 GROUNDWATER
SITES 3, 7, 14, 15, 18, AND 20 GROUNDWATER RECORD OF DECISION
NSB-NLON, GROTON, CONNECTICUT**

Sample Date	TCE	Benzo(a)pyrene	Arsenic	Silver	Thallium
2WCMW1S					
4/5/1994 ⁽¹⁾	10 U	10 U	6.9 J	2.0 U	10.0 UJ
7/11/1994	10 U	10 U	8.7 J	2.0 UJ	5.6 J
7/25/2000	1 U	0.05 U	15.1	326 J	3.0 U
10/16/2002	NA	NA	3.2 J	4.8 U	4.4 U
Dissolved Metals					
4/5/1994	---	---	6.9	2.0 U	10.0 UJ
7/11/1994	---	---	7.3 J	2.0 UJ	5.0 UJ
10/16/2002	---	---	3.4 J	4.8 U	4.4 U
2WCMW2S					
4/5/1994	10.0 U	10.0 U	4.9 J	2.0 U	13.8 J
7/11/1994	10 U	10 U	5.0 UJ	2.0 U	5.0 U
7/25/2000	5.02 J	0.05	2.3 U	114 J	3.0 U
10/17/2002	NA	NA	2.0 U	4.8 U	4.4 U
Dissolved Metals					
4/5/1994	---	---	6.1	3.7	10.0 UJ
7/11/1994	---	---	5.0 U	2.0 U	5.0 U
10/17/2002	---	---	2.0 U	4.8 U	4.4 U
2WCMW3S					
3/31/1994	10 U	10 U	11.9	2.0 U	1.0 UJ
7/10/1994	10 U	10 U	19.9 J	2.0 UJ	5.7 J
7/26/2000	1 U	0.05 U	4.1 J	5.2 U	3.8 J
Dissolved Metals					
3/31/1994	---	---	3.1 J	2.0 U	1.5 U
7/10/1994	---	---	8.4 J	2.0 UJ	5.0 UJ
7/26/2000	---	---	2.3 U	5.2 U	3.0 U
2WCMW4D					
1/24/1991	5 U	10 U	3.0 U	7.0 UJ	2.0 UR
4/5/1994	2 J	10 U	2.0 U	2.0 U	1.0 U
7/11/1994	10 U	10 U	5.0 UJ	2.0 U	5.0 U
7/24/2000	3.8 J	0.05 U	2.3 U	6.0 U	3.0 U
Dissolved Metals					
4/5/1994	---	---	2.0 U	2.0 U	1.0 UJ
7/11/1994	---	---	5.0 U	2.0 U	5.0 U

Taken from Basewide Groundwater Operable Unit Remedial Investigation Update/Feasibility Study Report (TtNUS, 2004).

NOTES:

- 1 The reported result is an average of the original sample and its duplicate.
- NA Not analyzed.
- Not applicable.
- U Parameter not detected. The value reported is the detection limit.
- J Estimated result.
- R Rejected result.

TABLE 2-23

**SUMMARY OF SITE 20 WATER QUALITY DATA
SITES 3, 7, 14, 15, 18, AND 20 GROUNDWATER RECORD OF DECISION
NSB-NLON, GROTON, CONNECTICUT**

2WCMW1S	Pump Type	Water Level (ft below)	Flow (mL/min)	pH (S.U.)	Turbidity (NTU)	DO (mg/L)	ORP (mV)	TSS (mg/L)	TDS (mg/L)	Total Iron (µg/L)	Dissolved Iron (µg/L)	Total Aluminum (µg/L)	Dissolved Aluminum (µg/L)
4/5/1994	NS	NS	NS	6.14	NS	4.37	NS	NA	NA	39400	35200	4670	36.9 U
7/11/1994	NS	NS	NS	6.46	13	1.69	NS	NA	NA	13800 J	9340	1090 J	29.4 U
7/25/2000	R	11.95	120	6.22	7	1.48	-118	5 U	1160	40200	NA	145 U	NA
10/16/2002	P	11.94	100	5.99	3	0.98	-86.2	NA	NA	50900	38000 J	180 U	41 U

2WCMW2S	Pump Type	Water Level (ft below)	Flow (mL/min)	pH (S.U.)	Turbidity (NTU)	DO (mg/L)	ORP (mV)	TSS (mg/L)	TDS (mg/L)	Total Iron (µg/L)	Dissolved Iron (µg/L)	Total Aluminum (µg/L)	Dissolved Aluminum (µg/L)
4/5/1994	NS	NS	NS	6.44	NS	4.34	NS	NA	NA	68000	69200	103 U	33.8 U
7/11/1994	NS	NS	NS	6.23	40	0.5	NS	NA	NA	43100	43700 J	56.6 U	45.9 U
7/25/2000	R	4.42	350	6.3	2.9	0.61	-100	8	211	25900	NA	73.7 U	NA
10/17/2002	P	4.59	150	5.9	5.66	2.12	41.9	NA	NA	2970	7.7 U	257	2760 J

2WCMW3S	Pump Type	Water Level (ft below)	Flow (mL/min)	pH (S.U.)	Turbidity (NTU)	DO (mg/L)	ORP (mV)	TSS (mg/L)	TDS (mg/L)	Total Iron (µg/L)	Dissolved Iron (µg/L)	Total Aluminum (µg/L)	Dissolved Aluminum (µg/L)
3/31/1994	NS	NS	NS	6.36	NS	3.05	NS	NA	NA	20400	4610	8330	40.5 U
7/10/1994	NS	NS	NS	6.89	10	-4.6 ⁽²⁾	NS	NA	NA	22000 J	10300 J	9210 J	27.6 U
7/26/2000	R	11.49	200	6.32	25	0.85	-396	2788 J	5142 J	14900	86.8 U	168 U	161 U

2WCMW4D	Pump Type	Water Level (ft below)	Flow (mL/min)	pH (S.U.)	Turbidity (NTU)	DO (mg/L)	ORP (mV)	TSS (mg/L)	TDS (mg/L)	Total Iron (µg/L)	Dissolved Iron (µg/L)	Total Aluminum (µg/L)	Dissolved Aluminum (µg/L)
1/24/1991	NS	NS	NS	NS	NS	NS	NS	NA	NA	65.2 J	NA	30 U	NA
4/5/1994	NS	NS	NS	7.9	20	0.81	NS	NA	NA	3220	25.3 U	182 U	19.2 U
7/11/1994	NS	NS	NS	8.06	10	0.75	NS	NA	NA	7180	67.7 U	291	31.8 U
7/24/2000	R	11.02	430	7.65	1.5	0.96	-41	5 U	135	188 U	NA	50.5 U	NA

Taken from Basewide Groundwater Operable Unit Remedial Investigation Update/Feasibility Study Report (TtNUS, 2004).

NOTES:

- 1 The reported result is an average of the original sample and its duplicate.
- 2 Equipment problems.

NS	Not Specified	S.C.	Specific conductivity	mL/min	Milliliters per minute
NA	Not Analyzed	DO	Dissolved oxygen	S.U.	Standard units
P	Peristaltic Pump	ORP	Oxidation reduction potential	uS/cm	Microsiemens per centimeter
R	Redi-flo Grundfos Pump (2-inch)	TSS	Total suspended solids	mg/L	Milligrams per liter
TOC	Top of Casing	NTU	Nephelometric turbidity units	mV	Millivolts
C	Celsius	ppt	Parts per thousand		

TABLE 2-24

**SELECTION OF HUMAN HEALTH RISK ASSESSMENT EXPOSURE PATHWAYS FOR SITES 3, 7, 14, 15, 18, AND 20
SITES 3, 7, 14, 15, 18, AND 20 GROUNDWATER RECORD OF DECISION
NSB-NLON, GROTON, CONNECTICUT**

Scenario Timeframe	Medium	Exposure Medium	Exposure Point	Receptor Population	Receptor Age	Exposure Route	On-Site/ Off-Site	Type of Analysis	Rationale for Selection or Exclusion of Exposure Pathway
Current/Future	Groundwater	Groundwater	Overburden/Bedrock Aquifer	Construction Workers	Adult	Ingestion Dermal	On-Site On-Site	None Quant	Construction workers may have dermal contact with groundwater during excavation activities.
				Residents	Adult	Ingestion Dermal	On-Site On-Site	Quant Quant	Groundwater may be used as a potable water source in the future.
					Child	Ingestion Dermal	On-Site On-Site	None None	Exposures to a child resident are less than those for an adult resident
		Air	Overburden/Bedrock Aquifer	Construction Workers	Adult	Inhalation	On-site	None	Construction workers exposure via volatilization is expected to be insignificant due to dilution with outdoor air.
				Residents	Adult	Inhalation	On-site	Quant	On-site residents may be exposed to volatile emissions from groundwater while showering.
					Child	Inhalation	On-site	None	Exposures to a child resident are less than those for an adult resident

TABLE 2-25

**SUMMARY OF CANCER RISKS AND HAZARD INDICES FOR SITE 3 GROUNDWATER
REASONABLE MAXIMUM EXPOSURES
SITES 3, 7, 14, 15, 18, AND 20 GROUNDWATER RECORD OF DECISION
NSB-NLON, GROTON, CONNECTICUT**

Receptor	Media	Exposure Route	Cancer Risk	Chemicals with Cancer Risks > 10 ⁻⁴	Chemicals with Cancer Risks > 10 ⁻⁵ and ≤ 10 ⁻⁴	Chemicals with Cancer Risks > 10 ⁻⁶ and ≤ 10 ⁻⁵	Hazard Index	Chemicals with HI > 1
Construction Worker	Groundwater	Dermal Contact	1.3E-06	--	--	--	0.001	--
Adult Resident	Groundwater	Ingestion	5.1E-04	Arsenic	Vinyl Chloride, Benzo(a)pyrene, Dibenzo(a,h)anthracene	1,1,2-Trichloroethane, Indeno(1,2,3-cd)pyrene, alpha-BHC	2.4	Arsenic
		Dermal Contact	8.6E-04	Benzo(a)pyrene, Dibenzo(a,h)anthracene	Indeno(1,2,3-cd)pyrene	alpha-BHC, Arsenic	0.009	--
		Inhalation (1)	1.9E-05	--	Vinyl Chloride	1,1,2-Trichloroethane	0.04	--
		Total	1.4E-03	Benzo(a)pyrene, Dibenzo(a,h)anthracene, Arsenic	Vinyl Chloride, Indeno(1,2,3-cd)pyrene	1,1,2-Trichloroethane, alpha-BHC	2.4	Arsenic

Taken from Basewide Groundwater Operable Unit Remedial Investigation Update/Feasibility Study (TiNUS, 2004).

Notes:

1 - Inhalation risk is assumed to be equal to risk from ingestion for volatiles.

TABLE 2-26

**SUMMARY OF CANCER RISKS AND HAZARD INDICES FOR SITE 3 GROUNDWATER
CENTRAL TENDENCY EXPOSURES
SITES 3, 7, 14, 15, 18, AND 20 GROUNDWATER RECORD OF DECISION
NSB-NLON, GROTON, CONNECTICUT**

Receptor	Media	Exposure Route	Cancer Risk	Chemicals with Cancer Risks > 10 ⁻⁴	Chemicals with Cancer Risks > 10 ⁻⁵ and ≤ 10 ⁻⁴	Chemicals with Cancer Risks > 10 ⁻⁶ and ≤ 10 ⁻⁵	Hazard Index	Chemicals with HI > 1
Construction Worker	Groundwater	Dermal Contact	4.4E-07	--	--	--	0.0003	--
Adult Resident	Groundwater	Ingestion	7.1E-05	--	Arsenic	Vinyl Chloride, Benzo(a)pyrene, Dibenzo(a,h)anthracene	1.1	Arsenic
		Dermal Contact	1.4E-04	--	Benzo(a)anthracene, Dibenzo(a,h)anthracene	Indeno(1,2,3-cd)pyrene	0.005	--
		Inhalation (1)	2.6E-06	--	--	Vinyl Chloride	0.02	--
		Total	2.2E-04	--	Benzo(a)anthracene, Dibenzo(a,h)anthracene, Arsenic	Vinyl Chloride, Indeno(1,2,3-cd)pyrene	1.1	Arsenic

Taken from Basewide Groundwater Operable Unit Remedial Investigation Update/Feasibility Study (TtNUS, 2004).

Notes:

1 - Inhalation risk is assumed to be equal to risk from ingestion for volatiles.

TABLE 2-27

**SUMMARY OF CANCER RISKS AND HAZARD INDICES FOR SITE 7 GROUNDWATER
REASONABLE MAXIMUM EXPOSURES
SITES 3, 7, 14, 15, 18, AND 20 GROUNDWATER RECORD OF DECISION
NSB-NLON, GROTON, CONNECTICUT**

Receptor	Media	Exposure Route	Cancer Risk	Chemicals with Cancer Risks $> 10^{-4}$	Chemicals with Cancer Risks $> 10^{-5}$ and $\leq 10^{-4}$	Chemicals with Cancer Risks $> 10^{-6}$ and $\leq 10^{-5}$	Hazard Index	Chemicals with HI > 1
Construction Worker	Groundwater	Dermal Contact	4.2E-07	--	--	--	0.09	--
Adult Resident	Groundwater	Ingestion	3.2E-04	Arsenic	Bis(2-ethylhexyl)phthalate, 1,4-Dichlorobenzene, Hexachlorobenzene	Benzene, Trichloroethene	3.8	Arsenic, Chromium
		Dermal Contact	2.9E-04	Hexachlorobenzene	Bis(2-ethylhexyl)phthalate, 1,4-Dichlorobenzene	--	1.3	--
		Inhalation ⁽¹⁾	3E-05	--	1,4-Dichlorobenzene	Benzene, Trichloroethene	0.5	--
		Total	6.4E-04	Arsenic, Hexachlorobenzene	Bis(2-ethylhexyl)phthalate, 1,4-Dichlorobenzene	Benzene, Trichloroethene	5.6	Arsenic, Chromium

Taken from Basewide Groundwater Operable Unit Remedial Investigation Report (TtNUS, 2002a).

Notes:

1 - Inhalation risk is assumed to be equal to risk from ingestion for volatiles.

TABLE 2-28

**SUMMARY OF CANCER RISKS AND HAZARD INDICES FOR SITE 7 GROUNDWATER
CENTRAL TENDENCY EXPOSURES
SITES 3, 7, 14,15, 18, AND 20 GROUNDWATER RECORD OF DECISION
NSB-NLON, GROTON, CONNECTICUT**

Receptor	Medium	Exposure Route	Cancer Risk	Chemicals with Cancer Risks > 10 ⁻⁴	Chemicals with Cancer Risks > 10 ⁻⁶ and ≤ 10 ⁻⁴	Chemicals with Cancer Risks > 10 ⁻⁶ and ≤ 10 ⁻⁵	Hazard Index	Chemicals with HI > 1
Construction Worker	Groundwater	Dermal Contact	1.0E-07	--	--	--	0.05	--
Adult Resident	Groundwater	Ingestion	1.2E-05	--	--	Arsenic, Hexachlorobenzene	0.2	--
		Dermal Contact	3.2E-05	--	Hexachlorobenzene	--	0.8	--
		Inhalation (1)	8.5E-08	--	--	--	0.02	--
		Total	4.4E-05	--	Hexachlorobenzene	Arsenic, Bis(2-ethylhexyl)phthalate	1.1	--

Taken from Basewide Groundwater Operable Unit Remedial Investigation Report (TtNUS, 2002a).

Notes:

1 - Inhalation risk is assumed to be equal to risk from ingestion for volatiles.

TABLE 2-29

**COMPARISONS OF POSITIVE GROUNDWATER ANALYTICAL RESULTS
AT SITE 14 TO SCREENING CRITERIA
SITES 3, 7, 14, 15, 18, AND 20 GROUNDWATER RECORD OF DECISION
NSB-NLON, GROTON, CONNECTICUT**

Location Sample Sample Date	S14MW01S S14MW01S-01 8/5/2000	Basewide Background (1)	USEPA Region 9 PRG (2)	CTDEP GA/GAA Criteria (3)	USEPA MCLs (4)	Connecticut MCLs (5)	CTDEP RSR Surface Water Protection Criteria⁽³⁾
Total Metals (ug/L)							
BARIUM	48.8	227	2600 N	1000	2000	2000	NA
CALCIUM	6890	188000	NA	NA	NA	NA	NA
IRON	1330	28200	11000 N	NA	300⁽⁶⁾	NA	NA
MAGNESIUM	3060	19100	NA	NA	NA	NA	NA
MANGANESE	88.2	11700	880 N	NA	50⁽⁶⁾	NA	NA
POTASSIUM	2780	70800	NA	NA	NA	NA	NA
SODIUM	31500	1900000	NA	NA	NA	NA	NA
Miscellaneous Parameters (mg/L)							
TOTAL DISSOLVED SOLIDS	122 J	6260	NA	NA	500 ⁽⁶⁾	NA	NA

Taken from Basewide Groundwater Operable Unit Remedial Investigation Update/Feasibility Study (TtNUS, 2004).

Notes:

NA - not available

RBC - Risk-Based Concentration

PRG - Preliminary Remedial Goals

MCL - Maximum Contaminant Level

1 - 96 Percent Upper Tolerance Limit (UTL) of site background data. BGOURI Report (TtNUS, 2002a).

2 - EPA Region 9 Preliminary Remedial Goals Table, Residential, 2002b (ICR = 1E-6, HQ = 1.0).

3 - CTDEP RSRs, Residential, 1996.

4 - EPA Drinking Water Standards and Health Advisories, 2002a.

5 - Title 19, Health and Safety, the Public Code of the State of Connecticut.

6 - Secondary MCL

TABLE 2-30

**SUMMARY OF CANCER RISKS AND HAZARD INDICES FOR SITE 15
REASONABLE MAXIMUM EXPOSURES
SITES 3, 7, 14, 15, 18, AND 20 GROUNDWATER RECORD OF DECISION
NSB-NLON, GROTON, CONNECTICUT**

Receptor	Media	Exposure Route	Cancer Risk	Chemicals with Cancer Risks > 10 ⁻⁴	Chemicals with Cancer Risks > 10 ⁻⁵ and ≤ 10 ⁻⁴	Chemicals with Cancer Risks > 10 ⁻⁶ and ≤ 10 ⁻⁵	Hazard Index	Chemicals with HI > 1
Construction Worker	Surface/Subsurface Soil	Ingestion	3.5E-07	--	--	--	0.2	--
		Dermal Contact	1.7E-08	--	--	--	0.003	--
		Total	3.7E-07	--	--	--	0.2	--
	Groundwater	Dermal Contact	NC	--	--	--	0.002	--
		Total All Media	3.7E-07				0.2	
Full-Time Employees	Surface Soil ⁽¹⁾	Ingestion	2.3E-06	--	--	Arsenic	0.05	--
		Dermal Contact	5.2E-07	--	--	--	0.004	--
		Total	2.8E-06	--	--	Arsenic	0.06	--
Adolescent Trespasser	Surface Soil ⁽¹⁾	Ingestion	1.2E-06	--	--	Arsenic	0.07	--
		Dermal Contact	2.2E-07	--	--	--	0.004	--
		Total	1.4E-06	--	--	Arsenic	0.07	--
Child Resident	Surface/Subsurface Soil	Ingestion	5.1E-06	--	--	Arsenic	0.5	--
		Dermal Contact	3.1E-07	--	--	--	0.01	--
		Total	5.4E-06	--	--	Arsenic	0.5	--
Adult Resident	Surface/Subsurface Soil	Ingestion	2.2E-06	--	--	Arsenic	0.05	--
		Dermal Contact	1.7E-07	--	--	--	0.001	--
		Total	2.4E-06	--	--	Arsenic	0.05	--
	Groundwater	Ingestion	NC	--	--	--	0.2	--
		Dermal Contact	NC	--	--	--	0.01	--
		Inhalation ⁽²⁾	NC	--	--	--	0	--
		Total	NC	--	--	--	0.3	--
		Total All Media	2.4E-06				0.3	

From Basewide Groundwater Operable Unit Remedial Investigation Update/Feasibility Study (TtNUS, 2004).

Notes:

1 - Assumes the pavement is removed.

2 - Inhalation risk is assumed to be equal to risk from ingestion for volatiles.

NC - Not calculated. There were no carcinogenic COPCs identified for groundwater.

TABLE 2-31

**SUMMARY OF CANCER RISKS AND HAZARD INDICES FOR SITE 15
CENTRAL TENDENCY EXPOSURES
SITES 3, 7, 14, 15, 18, AND 20 GROUNDWATER RECORD OF DECISION
NSB-NLON, GROTON, CONNECTICUT**

Receptor	Media	Exposure Route	Cancer Risk	Chemicals with Cancer Risks > 10 ⁻⁴	Chemicals with Cancer Risks > 10 ⁻⁵ and ≤ 10 ⁻⁴	Chemicals with Cancer Risks > 10 ⁻⁶ and ≤ 10 ⁻⁵	Hazard Index	Chemicals with HI > 1
Construction Worker	Surface/Subsurface Soil	Ingestion	1.2E-07	--	--	--	0.07	--
		Dermal Contact	1.1E-09	--	--	--	0.0002	--
		Total	1.2E-07	--	--	--	0.07	--
	Groundwater	Dermal Contact	NC	--	--	--	0.0005	--
		Total All Media	1.2E-07				0.07	
Full-Time Workers	Surface Soil ⁽¹⁾	Ingestion	2.7E-07	--	--	--	0.03	--
		Dermal Contact	1.2E-08	--	--	--	0.0004	--
		Total	2.9E-07	--	--	--	0.03	--
Adolescent Trespasser	Surface Soil ⁽¹⁾	Ingestion	7.7E-08	--	--	--	0.01	--
		Dermal Contact	8.8E-09	--	--	--	0.0006	--
		Total	8.6E-08	--	--	--	0.01	--
Child Resident	Surface/Subsurface Soil	Ingestion	8.5E-07	--	--	--	0.2	--
		Dermal Contact	1.8E-08	--	--	--	0.002	--
		Total	8.7E-07	--	--	--	0.2	--
Adult Resident	Surface/Subsurface Soil	Ingestion	3.2E-07	--	--	--	0.03	--
		Dermal Contact	7.3E-09	--	--	--	0.0002	--
		Total	3.3E-07	--	--	--	0.03	--
	Groundwater	Ingestion	NC	--	--	--	0.1	--
		Dermal Contact	NC	--	--	--	0.005	--
		Inhalation ⁽²⁾	NC	--	--	--	0	--
		Total	NC	--	--	--	0.1	--
		Total All Media	3.3E-07				0.1	

From Basewide Groundwater Operable Unit Remedial Investigation Update/Feasibility Study (TtNUS, 2004).

Notes:

1 - Assumes the pavement is removed.

2 - Inhalation risk is assumed to be equal to risk from ingestion for volatiles.

NC - Not calculated. There were no carcinogenic COPCs identified for groundwater.

TABLE 2-32

**SUMMARY OF CANCER RISKS AND HAZARD INDICES FOR SITE 20 GROUNDWATER
REASONABLE MAXIMUM EXPOSURES
SITES 3, 7, 14, 15, 18, AND 20 GROUNDWATER RECORD OF DECISION
NSB-NLON, GROTON, CONNECTICUT**

Receptor	Media	Exposure Route	Cancer Risk	Chemicals with Cancer Risks > 10 ⁻⁴	Chemicals with Cancer Risks > 10 ⁻⁵ and ≤ 10 ⁻⁴	Chemicals with Cancer Risks > 10 ⁻⁶ and ≤ 10 ⁻⁵	Hazard Index	Chemicals with HI > 1
Construction Worker	Groundwater	Dermal Contact	1.1E-07	--	--	--	0.0002	--
Adult Resident	Groundwater	Ingestion	2.7E-04	Arsenic	--	Benzo(a)pyrene	5.1	Arsenic, Silver, Thallium
		Dermal Contact	7.4E-05	--	Benzo(a)pyrene	--	0.003	--
		Inhalation ⁽¹⁾	6.5E-07	--	--	--	0.02	--
		Total	3.5E-04	Arsenic	Benzo(a)pyrene	Trichloroethene	5.1	Arsenic, Silver, Thallium

Taken from Basewide Groundwater Operable Unit Remedial Investigation Report (TtNUS, 2002a).

Notes:

1 - Inhalation risk is assumed to be equal to risk from ingestion for volatiles.

TABLE 2-33

**SUMMARY OF CANCER RISKS AND HAZARD INDICES FOR SITE 20 GROUNDWATER
CENTRAL TENDENCY EXPOSURES
SITES 3, 7, 14, 15, 18, AND 20 GROUNDWATER RECORD OF DECISION
NSB-NLON, GROTON, CONNECTICUT**

Receptor	Media	Exposure Route	Cancer Risk	Chemicals with Cancer Risks $> 10^{-4}$	Chemicals with Cancer Risks $> 10^{-5}$ and $\leq 10^{-4}$	Chemicals with Cancer Risks $> 10^{-6}$ and $\leq 10^{-5}$	Hazard Index	Chemicals with HI > 1
Construction Worker	Groundwater	Dermal Contact	2.5E-08	--	--	--	0.00008	--
Adult Resident	Groundwater	Ingestion	1.4E-05	--	Arsenic	--	1.0	--
		Dermal Contact	7.6E-06	--	--	Benzo(a)pyrene	0.002	--
		Inhalation (1)	4.5E-08	--	--	--	0.005	--
		Total	2.1E-05	--	Arsenic	Benzo(a)pyrene	1.0	--

Taken from Basewide Groundwater Operable Unit Remedial Investigation Report (TtNUS, 2002a).

Notes:

1 - Inhalation risk is assumed to be equal to risk from ingestion for volatiles.

TABLE 2-34

**SCREENING RISK EVALUATION FOR SITE 20
SITES 3, 7, 14, 15, 18, AND 20 GROUNDWATER RECORD OF DECISION
NSB-NLON, GROTON, CONNECTICUT**

Chemical ⁽¹⁾	Basewide Groundwater RI ⁽²⁾			Data Gap Investigation		
	Maximum Detected Concentration	Cancer Risk	Hazard Quotient	Maximum Detected Concentration	Cancer Risk	Hazard Quotient
Volatile Organic Compounds						
Trichloroethene	5.02 J	1.4E-06	0.05	(3)		
Semivolatile Organic Compounds						
Benzo(a)pyrene	0.05	7.8E-05		(3)		
Metals						
Antimony	3.5 J		0.2	2.1 U		
Arsenic	15.1	2.7E-04	1.4	3.2 J	5.6E-05	0.3
Nickel	102		0.1	10.7 U		
Silver	326 J		1.8	4.8 U		
Thallium	3.8 J		1.5	4.4 U		
Total						
		3.5E-04	5.1		5.6E-05	0.3

Notes:

- 1 - Chemicals with concentrations exceeding screening levels in either BGOURI and/or BGOURI Update/FS groundwater samples.
 - 2 - Results are from the BGOURI Report (TtNUS, 2002a).
 - 3 - Groundwater samples collected during the DGI [BGOURI Update/FS (TtNUS, 2004)] were only analyzed for inorganics.
- J = Estimated concentration.

TABLE 2-35

SELECTION OF ECOLOGICAL COPCS IN GROUNDWATER AT SITE 3 - NSA
SITES 3, 7, 14, 15, 18, AND 20 GROUNDWATER RECORD OF DECISION
NSB-NLON, GROTON, CONNECTICUT
PAGE 1 OF 2

Chemicals Detected in Groundwater	Detection Frequency ⁽¹⁾	Minimum Concentration ⁽²⁾	Maximum Concentration ⁽²⁾	Location of Maximum Concentration	Background Concentration ⁽³⁾	Surface Water Screening Value	Ecological Effects Quotient ⁽⁴⁾	Retain as a COPC?	Rationale for Chemical Selection or Elimination ⁽⁵⁾
Volatile Organics (µg/L)									
1,1,2-TRICHLOROETHANE	1/5	2 J	2 J	S3GW3TW2701	--	1200	0.002	NO	BSL
CIS-1,2-DICHLOROETHENE	4/5	0.7 J	3	S3GW2DMW29S04 S3GW3TW2801-D	--	590	0.01	NO	BSL
TOLUENE	2/5	0.2 J	0.3 J	S3GW3TW2701 S3GW3TW2801	--	9.8	0.03	NO	BSL
TOTAL 1,2-DICHLOROETHENE	2/2	0.7 J	3	S3GW2DMW29S04 S3GW3TW2801	--	590	0.01	NO	BSL
TRANS-1,2-DICHLOROETHENE	1/5	0.2 J	0.2 J	S3GW3TW2801-D	--	590	0.0003	NO	BSL
TRICHLOROETHENE	3/5	0.5 J	2	S3GW3TW2801-D	--	47	0.04	NO	BSL
VINYL CHLORIDE	3/5	0.3 J	2 J	S3GW3TW2701	--	NA	--	YES	NTX
Semivolatile Organics (µg/L)									
ACENAPHTHENE	2/5	0.11 J	0.13 J	S3GW3TW2801 S3GW3TW2801-D	--	23	0.01	NO	BSL
BENZO(A)PYRENE	1/5	0.13 J	0.13 J	S3GW3TW2801	--	0.014	9.29	YES	ASL
BENZO(G,H,I)PERYLENE	1/5	0.28	0.28	S3GW3TW2801	--	NA	--	YES	NTX
BENZO(K)FLUORANTHENE	1/5	0.08 J	0.08 J	S3GW3TW2801	--	NA	--	YES	NTX
DIBENZO(A,H)ANTHRACENE	1/5	0.3	0.3	S3GW3TW2801	--	NA	--	YES	NTX
FLUORENE	2/5	0.24 J	0.36 J	S3GW3TW2801	--	3.9	0.1	NO	BSL
INDENO(1,2,3-CD)PYRENE	1/5	0.35	0.35	S3GW3TW2801	--	NA	--	YES	NTX
Pesticides/PCBs(µg/L)									
ALPHA-BHC	1/3	0.025	0.028	S3GW3TW2801	--	2.2	0.01	NO	BSL
BETA-BHC	1/2	0.015 J	0.017	S3GW3TW2801-D	--	2.2	0.01	NO	BSL
Total Metals(µg/L)									
ALUMINUM	2/3	732 J	6780 J	S3GW3TW2701	3560	87	78	YES	ASL
ARSENIC	2/5	2 J	25.4	S3GW2DMW29S04	1.92	150	0.17	NO	BSL
BARIUM	3/3	30	74.8	S3GW3TW3001	227	4	18.7	YES	ASL
CALCIUM	3/3	13300	19100	S3GW3TW3001	188,000	NA	--	NO	EN
CHROMIUM	2/3	5.8	8.4	S3GW3TW2701	49.9	11	0.76	NO	BSL
COPPER	2/3	4.3	14.2	S3GW3TW2801	107	4.8	2.96	YES	ASL
IRON	2/3	18000	20000	S3GW3TW2801	28,200	1000	20	YES	ASL
LEAD	2/3	2.2	8.4	S3GW3TW2701	6.63	1.2	7	YES	ASL
MAGNESIUM	3/3	4410	5770	S3GW3TW3001	191,000	NA	--	NO	EN
MANGANESE	3/3	56.7	764	S3GW3TW2701	11,700	120	6.4	YES	ASL
POTASSIUM	3/3	3650	4540	S3GW3TW2801-D	70,800	NA	--	NO	EN
SODIUM	3/3	52400	68800	S3GW3TW3001	1,900,000	NA	--	NO	EN
VANADIUM	2/3	12.1	12.1	S3GW3TW2701 S3GW3TW2801	10.2	NA	--	YES	NTX
Filtered Metals(ug/L)									
ARSENIC-FILTERED	2/5	2 J	3.5	S3GW2DMW29S04-F	2.55	150	0.02	NO	BSL
BARIUM-FILTERED	3/3	23.1	75.6	S3GW3TW3001-F	124	4	18.9	YES	ASL
CALCIUM-FILTERED	3/3	13800	19100	S3GW3TW3001-F	152,000	NA	--	NO	EN
IRON-FILTERED	2/3	12000	15200	S3GW3TW2801-F-D	25,300	1000	15.2	YES	ASL
MAGNESIUM-FILTERED	3/3	3730	5810	S3GW3TW3001-F	150,000	NA	--	NO	EN
MANGANESE-FILTERED	3/3	58.6	496	S3GW3TW2701-F	9,400	120	4.13	YES	ASL
POTASSIUM-FILTERED	3/3	3650	4870	S3GW3TW2801-F-D	60,000	NA	--	NO	EN
SODIUM-FILTERED	3/3	55600	69400	S3GW3TW3001-F	1,580,000	NA	--	NO	EN

TABLE 2-35

**SELECTION OF ECOLOGICAL COPCs IN GROUNDWATER AT SITE 3 - NSA
SITES 3, 7, 14, 15, 18, AND 20 GROUNDWATER RECORD OF DECISION
NSB-NLON, GROTON, CONNECTICUT
PAGE 2 OF 2**

Chemicals Detected in Groundwater	Detection Frequency ⁽¹⁾	Minimum Concentration ⁽²⁾	Maximum Concentration ⁽²⁾	Location of Maximum Concentration	Background Concentration ⁽³⁾	Surface Water Screening Value	Ecological Effects Quotient ⁽⁴⁾	Retain as a COPC?	Rationale for Chemical Selection or Elimination ⁽⁵⁾
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Taken from Basewide Groundwater Operable Unit Remedial Investigaiton Update/Feasibility Study (TtNUS, 2004).

Footnotes:

- 1 Sample and duplicate were counted as one sample when calculating the frequency of detection.
- 2 Sample and duplicate were counted as separate samples in determining the minimum and maximum concentrations.
- 3 Source of the background concentrations is Atlantic, April 1995. Background concentrations of Inorganics in Soil - NSB-NLON.
- 4 The ecological effects quotient was calculated by dividing the maximum concentration by the screening value.
- 5 Rationale codes for contaminant selection or deletion:

For Selection as a COPC:

- ASL = Above COPC screening level.
- NTX = No toxicity information available.

For Elimination as a COPC:

- BSL = Below COPC screening level.
- EN = Essential Nutrient.

Notes:

The background concentrations are presented for informational purposes only and were not used in the selection of COPCs.

Shaded name indicates that the constituent was selected as a COPC. Shaded values indicate that the site concentration(s) exceeds this particular criterion.

"--" Unavailable; background concentrations are not available for organic chemicals and an EEQ could not be calculated due to the lack of screening values.

J = Estimated concentrations.

TABLE 2-36

**SITES 3 AND 7 GROUNDWATER PRELIMINARY REMEDIATION GOALS (µg/L)
SITES 3, 7, 14, 15, 18, AND 20 GROUNDWATER RECORD OF DECISION
NSB-NLON, GROTON, CONNECTICUT**

Chemical of Concern	Maximum Detected Concentration - Groundwater⁽¹⁾	PRG for Protection of Construction Workers	PRG for Protection of Aquatic Ecological Receptors⁽²⁾	PRG for Protection of Future Potential Receptors⁽³⁾
Trichloroethene	23	No PRG (ICR <10 ⁻⁶ ; HI <0.1)	NA	5
Vinyl chloride	31	No PRG (ICR <10 ⁻⁶ ; HI <0.1)	NA	2
Hexachlorobenzene	3	No PRG (ICR <10 ⁻⁶ ; HI <0.1)	NA	1
Total Petroleum Hydrocarbons	Unknown	NA	No mobile free product ⁽⁴⁾	500

1 Concentration presented is the maximum concentration detected in the 2000 and 2002 sampling events.

2 Ecological life in the adjacent streams in which site groundwater may flow without dilution.

3 Future potential receptors consist of residents living at the site who use site groundwater as a source of potable water. Selected PRGs are based on federal and State of Connecticut drinking water and groundwater quality standards (see Appendix C, Table C-2 of the BGOURI Update/FS).

4 Petroleum-contaminated soil identified with Site 3 - NSA may contain sufficient free product to impact surface water.

ICR <10⁻⁶ Estimated carcinogenic risks are less than 1 x 10⁻⁶ for the maximum COC concentration.

HI <0.1 Estimated non-carcinogenic risks are less than 0.1 for the maximum COC concentration.

NA Not Applicable

TABLE 2-37

**SITE 7 GROUNDWATER PRELIMINARY REMEDIATION GOALS (µg/L)
SITES 3, 7, 14, 15, 18, AND 20 GROUNDWATER RECORD OF DECISION
NSB-NLON, GROTON, CONNECTICUT**

Chemical of Concern	Maximum Detected Concentration	PRG for Protection of Construction Worker	PRG for Protection of Aquatic Ecological Receptors⁽¹⁾	PRG for Protection of Future Potential Receptors⁽²⁾
1,4-Dichlorobenzene	90.5	No PRG, BSC	No PRG, BSC	75
Benzene	2	No PRG, BSC	No PRG, BSC	1
Chlorobenzene	165	No PRG, BSC	No PRG, BSC	100
Trichloroethene	23	No PRG, BSC	No PRG, BSC	5
Hexachlorobenzene	3	No PRG, BSC	No PRG	1

1 Ecological life in the adjacent streams in which site groundwater may flow without dilution.

2 Future potential receptors consist of residents living at the site who may use groundwater as a source of potable water. Human health PRGs are based on federal and State of Connecticut drinking water/groundwater quality standards (see Appendix C, Table C-4 of the BGOURI Update/FS).

BSC Below screening criteria. Contaminants at the site are present at concentrations less than appropriate human health and ecological screening criteria.

TABLE 2-38

**ASSESSMENT OF CHEMICAL-SPECIFIC ARARs AND TBCs FOR GROUNDWATER
ALTERNATIVES GW1-1 AND GW2-1 - NO ACTION
SITES 3, 7, 14, 15, 18, AND 20 GROUNDWATER RECORD OF DECISION
NSB-NLON, GROTON, CONNECTICUT**

FEDERAL

Requirement	Citation	Status	Synopsis of Requirement	Evaluation/Action to Be Taken
CSF	Not Applicable	To Be Considered	These are guidance values used in risk assessment to evaluate the potential carcinogenic hazard caused by exposure to contaminants.	The No Action Alternatives would not result in unacceptable risks to current receptors from exposure to contaminated groundwater under current conditions. However, because no restrictions on groundwater use would be implemented under the No Action Alternatives, future groundwater use for other purposes could result in unacceptable risks to receptors.
RfD	Not Applicable	To Be Considered	These are guidance values used in risk assessment to evaluate the potential non-carcinogenic hazard caused by exposure to contaminants.	The No Action Alternatives would not result in unacceptable risks to current receptors from exposure to contaminated groundwater under current conditions. However, because no restrictions on groundwater use would be implemented under the No Action Alternatives, future groundwater use for other purposes could result in unacceptable risks to receptors.

STATE OF CONNECTICUT

Requirement	Citation	Status	Synopsis of Requirement	Evaluation/Action to Be Taken
Remediation Standard Regulations	CGS 22a-133k; RCSA 22a-133k - 1 thru 3	Applicable	This regulation provides specific numerical cleanup criteria for contaminants in groundwater. Requirements are based on groundwater in the area being classified by the state as GB.	As long as groundwater at the site remains classified as GB, the alternatives would comply with the ARAR. If site groundwater is reclassified to GA, then the alternatives would not comply with ARAR.

TABLE 2-39

**ASSESSMENT OF CHEMICAL-SPECIFIC ARARs AND TBCs FOR GROUNDWATER
ALTERNATIVES GW1-2, GW2-2, AND SELECTED REMEDY
SITES 3, 7, 14, 15, 18, AND 20 GROUNDWATER RECORD OF DECISION
NSB-NLON, GROTON, CONNECTICUT**

FEDERAL

Requirement	Citation	Status	Synopsis of Requirement	Evaluation/Action to Be Taken
CSF	Not Applicable	To Be Considered	These are guidance values used in risk assessment to evaluate the potential carcinogenic hazard caused by exposure to contaminants.	Alternatives would prevent exposure to contaminated groundwater and monitor the migration and degradation of contaminants until concentrations are below acceptable levels that meet human health concerns.
RfD	Not Applicable	To Be Considered	These are guidance values used in risk assessment to evaluate the potential non-carcinogenic hazard caused by exposure to contaminants.	Alternatives would prevent exposure to contaminated groundwater and monitor the migration and degradation of contaminants until concentrations are below acceptable levels that meet human health concerns.

STATE OF CONNECTICUT

Requirement	Citation	Status	Synopsis of Requirement	Evaluation/Action to Be Taken
Remediation Standard Regulations	CGS 22a-133k; RCSA 22a-133k - 1 thru 3	Applicable	This regulation provides specific numerical cleanup criteria for contaminants in groundwater. Requirements are based on groundwater in the area being classified by the state as GB.	<p>Alternatives would comply with ARAR. Institutional controls or deed restriction (if the Navy sells the property in the future) would be implemented to prevent use of contaminated groundwater.</p> <p>Groundwater monitoring would be conducted to track the location, migration, and degradation of contaminants until concentrations are below acceptable levels.</p>

TABLE 2-40

**ASSESSMENT OF ACTION-SPECIFIC ARARs AND TBCs FOR GROUNDWATER
ALTERNATIVES GW1-2, GW2-2, AND SELECTED REMEDY
SITES 3, 7, 14, 15, 18, AND 20 GROUNDWATER RECORD OF DECISION
NSB-NLON, GROTON, CONNECTICUT
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FEDERAL

Requirement	Citation	Status	Synopsis of Requirement	Evaluation/Action to Be Taken
SDWA MCLs	42 USC 300f et. seq. 40 CFR Parts 141 to 143	Relevant and Appropriate	MCLs established under this act are health-based limits for certain chemical substances in drinking water. Site groundwater is not a current or planned future drinking water source. However, in the future, the site groundwater could be used as a potable water supply.	Alternatives would prevent exposure to contaminated groundwater and monitor the migration and degradation of contaminants until concentrations are below acceptable levels that meet human health concerns.
Clean Water Act, Section 403, Pretreatment Regulations	Section 403	Applicable	General pretreatment requirements for discharge to a publicly-owned treatment works.	Groundwater extracted during groundwater monitoring activities under this alternative will require testing and disposal. Discharge to a publicly-owned treatment works will be considered for disposal of the groundwater and these requirements will be met if it is determined to be applicable.

TABLE 2-40

**ASSESSMENT OF ACTION-SPECIFIC ARARs AND TBCs FOR GROUNDWATER
ALTERNATIVES GW1-2, GW2-2, AND SELECTED REMEDY
SITES 3, 7, 14, 15, 18, AND 20 GROUNDWATER RECORD OF DECISION
NSB-NLON, GROTON, CONNECTICUT
PAGE 2 OF 2**

STATE OF CONNECTICUT

Requirement	Citation	Status	Synopsis of Requirement	Evaluation/Action to Be Taken
Hazardous Waste Management: Generator and Handler Requirements	RCSA § 22a-449(c) 100-101	Applicable	Connecticut is delegated to administer the Federal Resource Conservation and Recovery Act statute through its state regulations. These sections establish standards for listing and identification of hazardous waste. The standards of 40 CFR 260-261 are incorporated by reference.	Waste generated during the installation of monitoring wells and monitoring activities under these alternatives will be properly characterized for disposal. Any waste determined to be hazardous through characterization will be managed in accordance with these regulations.
Hazardous Waste Management: Treatment, Storage, or Disposal Facility Standards	RCSA § 22a-449(c) 104	Applicable	These sections establish standards for treatment, storage, and disposal facilities. The standards of 40 CFR 264 are incorporated by reference.	Any hazardous waste generated during the installation of monitoring wells and monitoring activities and temporarily stored on-site will be managed in accordance with these regulations.
Water Quality Standards	CGS 22a-426 (Connecticut General Statutes)	Applicable	These standards specify Connecticut WQSS, classifications of water of the state, and anti-degradation policies for surface water and groundwater. Groundwater at the site is classified as GB.	Alternatives would prevent exposure to contaminated groundwater and monitor the migration and degradation of contaminants until concentrations are below acceptable levels that meet human health concerns.

TABLE 2-41

**ASSESSMENT OF CHEMICAL-SPECIFIC ARARs AND TBCs FOR GROUNDWATER
ALTERNATIVE GW2-3 – EXTRACTION AND OFF-SITE DISCHARGE
SITES 3, 7, 14, 15, 18, AND 20 GROUNDWATER RECORD OF DECISION
NSB-NLON, GROTON, CONNECTICUT**

FEDERAL

Requirement	Citation	Status	Synopsis of Requirement	Evaluation/Action to Be Taken
CSF	Not Applicable	To Be Considered	These are guidance values used in risk assessment to evaluate the potential carcinogenic hazard caused by exposure to contaminants.	Alternative would remove contaminated groundwater from the site, pre-treat the extracted water, if necessary, and discharge the water to the POTW for final treatment and discharge. After removal of contaminated groundwater above acceptable levels from the site, there would be no remaining unacceptable risks to human health.
RfD	Not Applicable	To Be Considered	These are guidance values used in risk assessment to evaluate the potential non-carcinogenic hazard caused by exposure to contaminants.	Alternative would remove contaminated groundwater from the site, pre-treat the extracted water, if necessary, and discharge the water to the POTW for final treatment and discharge. After removal of contaminated groundwater above acceptable levels from the site, there would be no remaining unacceptable risks to human health.

STATE OF CONNECTICUT

Requirement	Citation	Status	Synopsis of Requirement	Evaluation/Action to Be Taken
Remediation Standard Regulations	CGS 22a-133k; RCSA 22a-133k - 1 thru 3	Applicable	This regulation provides specific numerical cleanup criteria for contaminants in groundwater. Requirements are based on groundwater in the area being classified by the state as GB.	Alternative would comply with ARAR. Groundwater extraction would continue until contaminants concentrations are below acceptable levels.

TABLE 2-42

**ASSESSMENT OF ACTION-SPECIFIC ARARs AND TBCs FOR GROUNDWATER
ALTERNATIVE GW2-3 - EXTRACTION AND OFF-SITE DISCHARGE
SITES 3, 7, 14, 15, 18, AND 20 GROUNDWATER RECORD OF DECISION
NSB-NLON, GROTON, CONNECTICUT
PAGE 1 OF 2**

FEDERAL

Requirement	Citation	Status	Synopsis of Requirement	Evaluation/Action to be Taken
SDWA MCLs	42 USC 300f et. seq. 40 CFR Parts 141 to 143	Relevant and Appropriate	MCLs established under this act are health-based limits for certain chemical substances in drinking water. Site groundwater is not a current or planned future drinking water source. However, in the future, the site groundwater could be used as a potable water supply.	Alternative would extract contaminated groundwater until monitoring results show that contaminant concentrations are below acceptable levels that meet human health concerns.
Clean Water Act, Section 403, Pretreatment Regulations	Section 403	Applicable	General pretreatment requirements for discharge to a POTW. If remedial activities include such a discharge to the local sanitary sewer, pre-treatment standards would be ARARs. Standards would be enforced through the State program.	<p>The extracted water may require pre-treatment prior to discharge to the sanitary sewer system.</p> <p>Groundwater extracted during groundwater monitoring activities under this alternative will require testing and disposal. Discharge to a POTW will be considered for disposal of the groundwater and these requirements will be met if it is determined to be applicable.</p>

TABLE 2-42

**ASSESSMENT OF ACTION-SPECIFIC ARARs AND TBCs FOR GROUNDWATER
ALTERNATIVE GW2-3 - EXTRACTION AND OFF-SITE DISCHARGE
SITES 3, 7, 14, 15, 18, AND 20 GROUNDWATER RECORD OF DECISION
NSB-NLON, GROTON, CONNECTICUT
PAGE 2 OF 2**

STATE OF CONNECTICUT

Requirement	Citation	Status	Synopsis of Requirement	Evaluation/Action to be Taken
Hazardous Waste Management: Generator and Handler Requirements	RCSA § 22a-449(c) 100-101	Applicable	Connecticut is delegated to administer the Federal Resource Conservation and Recovery Act statute through its state regulations. These sections establish standards for listing and identification of hazardous waste. The standards of 40 CFR 260-261 are incorporated by reference.	Waste generated during the installation of monitoring wells and monitoring activities under this alternative will be properly characterized for disposal. Any waste determined to be hazardous through characterization will be managed in accordance with these regulations.
Hazardous Waste Management: Treatment, Storage, or Disposal Facility Standards	RCSA § 22a-449(c) 104	Applicable	These sections establish standards for treatment, storage, and disposal facilities. The standards of 40 CFR 264 are incorporated by reference.	Any hazardous waste generated during the installation of monitoring wells and monitoring activities and temporarily stored on-site will be managed in accordance with these regulations.
Water Quality Standards (WQSs)	CGS 22a-426 (Connecticut General Statutes)	Applicable	These standards specify Connecticut WQSs, classifications of water of the state, and anti-degradation policies for surface water and groundwater. Groundwater at the site is classified as GB.	Alternative would extract contaminated groundwater until monitoring results show that contaminant concentrations are below acceptable levels that meet human health concerns.
Connecticut Water Pollution Control Act	RCSA §22a - 416 to -599	Applicable	The regulations govern the treatment and discharge of water into surface water bodies in the state.	Applicable sections of the POTW permit would be used to determine pre-treatment requirements for extracted groundwater.

TABLE 2-43

**SITES 3 AND 7 GROUNDWATER REMEDIAL GOALS
FOR PROTECTION OF FUTURE RECEPTORS
SITES 3, 7, 14, 15, 18, AND 20 GROUNDWATER RECORD OF DECISION
NSB-NLON, GROTON, CONNECTICUT**

Contaminant of Concern (Site)	Remedial Goal for Protection of Future Potential Receptors ⁽¹⁾
Volatile Organic Compounds	
1,4-Dichlorobenzene (Site 7)	75 µg/L
Benzene (Site 7)	1 µg/L
Chlorobenzene (Site 7)	100 µg/L
Trichloroethene (Sites 3 and 7)	5 µg/L
Vinyl chloride (Site 3)	2 µg/L
Semi-volatile Organic Compounds	
Hexachlorobenzene (Sites 3 and 7)	1 µg/L

- 1 Future potential receptors consist of residents living at the site who may use groundwater as a source of potable water. Human health RGs are based on federal and State of Connecticut drinking water/groundwater quality standards.